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## Dia- and paramagnetic contributions to magnetizabilities of relativistic hydrogenlike atoms in some low-lying discrete energy eigenstates

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## ABSTRACT

In this paper we present tabulated data for relative diamagnetic and paramagnetic contributions to the magnetizability ( $\chi$ ) of the relativistic hydrogenlike atoms with a pointlike, motionless and spinless nucleus of charge  $Ze$ . Utilizing general analytical formulas for the diamagnetic ( $\chi_d$ ) and paramagnetic ( $\chi_p$ ) components of  $\chi$ , recently derived by us (P. Stefańska, 2020) with the aid of the Gordon decomposition technique, valid for an arbitrary discrete energy state, we have computed the numerical values of  $\chi_d/\chi$  and  $\chi_p/\chi$  for the ground state and for the first and the second set of excited states (i.e.:  $2s_{1/2}$ ,  $2p_{1/2}$ ,  $2p_{3/2}$ ,  $3s_{1/2}$ ,  $3p_{1/2}$ ,  $3p_{3/2}$ ,  $3d_{3/2}$ , and  $3d_{5/2}$ ) of the hydrogen atom ( $Z = 1$ ) and for hydrogenic ions with  $2 \leq Z \leq 137$ . We compare also the numerical values of the total magnetizabilities for the ground state  $1s_{1/2}$  and for each state belonging to the first set of excited states of selected hydrogenlike atoms, obtained with the use of two different values of the fine-structure constant, i.e.:  $\alpha^{-1} = 137.035\,999\,139$  (from CODATA 2014) and  $\alpha^{-1} = 137.035\,999\,084$  (from CODATA 2018).

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## 1. Introduction

Electromagnetic susceptibilities of atomic and molecular systems have long been the subject of research for both experimental and theoretical physicists. Most often, to determine these properties, it is necessary to place the tested atom (or molecule) in an external electric or/and magnetic field, and then observe the appropriate changes in this system. From the theoretical point of view, the influence of perturbing fields on atoms can be described by changing the electric charge (or current) density [1]. Within the framework of nonrelativistic Schrödinger–Pauli wave mechanics, the induced electric current density (and – consequently – many magnetic susceptibilities of the atom) may be obtained as the sum of a diamagnetic (Langevin–Larmor) and a paramagnetic (Van Vleck) term [2]. In this approach, the paramagnetic component is often found to be very small in magnitude or even vanishing, while the diamagnetic contribution turns out to be a dominant one.

In the purely relativistic theory, the above described decomposition of the atomic magnetic properties can be performed in some different ways, e.g. with the use of a separate summation over negative-energy states [3–6], by the unitary transformation of the Dirac operator [7], or by using the Gordon decomposition of the electric current density [8–14]. The latter approach was also used in Ref. [15], where the analytical expressions for diamagnetic and paramagnetic contributions to the magnetizability  $\chi$  of the relativistic one-electron atom in the *ground* state were derived. Recently, we have generalized the considerations from

Ref. [15] to an *arbitrary* discrete energy atomic eigenstate [16], i.e. we have received the magnetizability in the following form

$$\chi = \chi_d + \chi_p, \quad (1)$$

where diamagnetic ( $\chi_d$ ) and paramagnetic ( $\chi_p$ ) parts of  $\chi$  are obtained as the functions of the three quantum numbers  $\{n, \kappa, \mu\}$ , which characterize the atomic unperturbed state:  $n$  denotes the radial quantum number, the Dirac quantum number  $\kappa$  is an integer different from zero, whereas  $\mu$  is the magnetic quantum number. By utilizing the Sturmian expansion of the generalized Dirac–Coulomb Green function [17] (for some applications of this technique, see Refs. [18–27]), we arrived at the following general closed-form expressions:

$$\chi_d = -\frac{\alpha^2 a_0^3}{Z^2} \frac{4\kappa^2 + 4\mu^2 - 1}{16(4\kappa^2 - 1)} (n + \gamma_\kappa) \times [N_{n\kappa}(5n^2 + 10n\gamma_\kappa + 2\gamma_\kappa^2 + 1) - 3\kappa(n + \gamma_\kappa)] \quad (2)$$

and

$$\chi_p = \chi'_p + \chi''_p, \quad (3)$$

where

$$\chi'_p = \frac{\alpha^2 a_0^3}{Z^2} \sum_{+,-} \left(1 - \frac{4\mu^2}{(2\kappa \mp 1)^2}\right) \frac{(n + \gamma_\kappa \mp N_{n\kappa})^2}{128N_{n\kappa}(N_{n\kappa} - \kappa \pm 1)} \times \left[2\kappa - 4(n + \gamma_\kappa)N_{n\kappa} \pm 2n(n + 2\gamma_\kappa)\right]$$

$$\begin{aligned}
& + \frac{n! \Gamma(n + 2\gamma_\kappa + 1)}{(N_{n\kappa} - \kappa)(\gamma_{1\mp\kappa} - \gamma_\kappa - n + 1) \Gamma(2\gamma_{1\mp\kappa} + 1)} \\
& \times \sum_{k=0}^n \sum_{p=0}^n \tilde{z}_{n\kappa}^{(\pm)}(k) \tilde{z}_{n\kappa}^{(\pm)}(p) \\
& \times {}_3F_2 \left( \begin{matrix} \gamma_{1\mp\kappa} - \gamma_\kappa - k, \gamma_{1\mp\kappa} - \gamma_\kappa - p, \gamma_{1\mp\kappa} - \gamma_\kappa - n + 1 \\ \gamma_{1\mp\kappa} - \gamma_\kappa - n + 2, 2\gamma_{1\mp\kappa} + 1 \end{matrix}; 1 \right)
\end{aligned} \quad (4)$$

(here  $\sum_{+,-}(\dots)$  denotes that the components with the upper and lower signs should be added together), with

$$\tilde{z}_{n\kappa}^{(\pm)}(k) = \frac{(-)^k}{k!(n-k)!} [(n-k) \pm (N_{n\kappa} - \kappa)]^2 \frac{\Gamma(\gamma_\kappa + \gamma_{1\mp\kappa} + k + 1)}{\Gamma(k + 2\gamma_\kappa + 1)} \quad (5)$$

and analogously for  $\tilde{z}_{n\kappa}^{(\pm)}(p)$ , while

$$\chi_p'' = \frac{\alpha^2 a_0^3}{Z^2} \frac{\kappa(\kappa^2 - \mu^2)\mu^2}{4\kappa^2 - 1} \frac{2\kappa(n + \gamma_\kappa) - N_{n\kappa}}{2N_{n\kappa}}. \quad (6)$$

In the above equations,  $\alpha$  is the Sommerfeld's fine structure constant,  $a_0$  stands for the Bohr radius,  $\Gamma(\zeta)$  denotes the Euler's gamma function,  ${}_3F_2$  is the generalized hypergeometric function,

$$N_{n\kappa} = \sqrt{n^2 + 2n\gamma_\kappa + \kappa^2}, \quad (7)$$

and

$$\gamma_\kappa = \sqrt{\kappa^2 - (\alpha Z)^2}. \quad (8)$$

By exploiting Eqs. (2)–(6), we have verified that, as one would expect, the sum  $\chi_d + \chi_p$  coincides with the total magnetizability of the Dirac one-electron atoms in an arbitrary energy state, found by us a few years ago [22,23].

It should be clearly indicated here that our recent paper [16], apart from the analytical results presented above, contains only a few representative tables with the values of the relative para- and diamagnetic contributions to  $\chi$  for some excited states of selected hydrogenlike ions. Because in the scientific literature in vain to look for other such general results concerning the quantities discussed here, in this article we present a more comprehensive numerical data compared to those in Ref. [16]. Our results will be discussed briefly in the next section.

## 2. Discussion of results

Computational results presented in this work have been obtained with the aid of the exact analytical formulas given in Eqs. (2)–(6). Table 1 contains the values of the relative dia- and paramagnetic contributions to the magnetizability for the ground state ( $1s_{1/2}$ ) of the relativistic one-electron atoms. In Tables 2–5 we have included the results for states belonging to the first set of excited states, i.e.:  $2s_{1/2}$ ,  $2p_{1/2}$ , and  $2p_{3/2}$ , whereas results for the second excited atomic states (i.e.  $3s_{1/2}$ ,  $3p_{1/2}$ ,  $3p_{3/2}$ ,  $3d_{3/2}$  and  $3d_{5/2}$ ) are presented in Tables 6–14. For each state, all possible values of the magnetic quantum number  $\mu$  were considered.

All tabulated data were computed with the use of the newest value  $\alpha^{-1} = 137.035\,999\,084$  of the inverse of the fine-structure constant recommended by the Committee on Data for Science and Technology (CODATA) [28]. To show how the change in the value of  $\alpha$  affects the value of the magnetic susceptibilities, we performed additional calculations for the total magnetizability  $\chi$  with the current value of  $\alpha^{-1}$  and also with the previous value  $\alpha^{-1} = 137.035\,999\,139$  (from CODATA 2014) [29]. The appropriate juxtaposition of the numerical values of  $\chi$  for the ground state and for the first excited states of selected hydrogenlike ions is presented in Table 15.

A few representative results for the relative para- and diamagnetic contributions to the magnetizability of the hydrogenic ground state can be found in the work of Szmytkowski [15]. Since they were obtained by utilizing the  $\alpha^{-1} = 137.0359895$  (from CODATA 1986) [30], we have decided to make yet additional calculations (not presented here) for  $\chi_p/\chi$  and  $\chi_d/\chi$  for the state  $1s_{1/2}$ , taking into account just mentioned value of the inverse of the fine-structure constant. This allows us to compare our results with data provided in [15]. The agreement between these results turns out to be almost perfect. We have found some inconsistencies for the ion with  $Z = 120$  only: our value for  $\chi_p''/\chi = -1.136288773734$  is different from Szmytkowski's result  $\chi_p''/\chi = -1.28$ . Therefore, also  $\chi_p/\chi = -1.122168785351$  found by us does not overlap with  $\chi_p/\chi = -1.26$  predicted in Ref. [15].

After analyzing all the numbers from Tables 1–14 we conclude that always for all states with  $\kappa < 0$  and simultaneously with the maximal value of  $\mu$  (i.e. when the magnetic quantum number  $\mu$  is equal to the total angular momentum quantum number  $j$ ), we have  $|\chi_p'| \ll |\chi_p''|$ . Such relation occurs also for the atomic ground state; this agrees with the conclusions from [15]. Furthermore, for the class of atomic states described above, the diamagnetic contribution  $\chi_d$  always dominates over the paramagnetic one  $\chi_p$ . However, the one exception to this rule is the ground state  $1s_{1/2}$ , for which such relation occurs not for the whole range of atomic number, but only for  $Z < 130$ .

The opposite relation, i.e.  $|\chi_p''| \ll |\chi_p'|$ , applies to the states with the angular-plus-parity symmetry quantum number  $\kappa > 0$ . For states with  $\kappa < 0$  it holds only if  $\mu < j$  takes place simultaneously. Generally, for these states, one can observe that  $\chi_p$  is greater than the  $\chi_d$ . Nevertheless, there are some states from the class described above, for which such dominance does not occur for the entire atomic number range; it is most evident in the case of small  $Z$ 's and gradually decreases to a certain  $Z_c$  value, for which both contributions are almost equal, and then the diamagnetic component slowly begins to dominate over the paramagnetic one. For the first set of excited states, we have found  $Z_c = 117$  for  $2p_{1/2}$  and  $Z_c = 103$  for  $2p_{3/2}$  (with  $\mu = \pm 1/2$ ), whereas for the higher excited states such alignment of diamagnetic and paramagnetic contributions is already taking place for lower values of the nuclear charge number, i.e. there are  $Z_c = 84$  for  $3p_{1/2}$  and  $Z_c = 85$  for  $3p_{3/2}$  (with  $\mu = \pm 1/2$ ).

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Explanation of tables

- Table 1.** Relative dia- and paramagnetic contributions to magnetizabilities for the ground state ( $1s_{1/2}$ ) of hydrogenlike atoms, obtained with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018)
- Table 2.** Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $2s_{1/2}$ , obtained with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018)
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In all the tables we have used the following notations:

$\chi$	the atomic magnetizability
$\chi_d$	the diamagnetic part of the atomic magnetizability
$\chi_p$	the paramagnetic part of the atomic magnetizability
$Z$	the nuclear charge number
$\alpha$	the fine-structure constant
$a_0$	the Bohr radius
$a(b)$	this means $a \times 10^b$
$\mu$	the magnetic quantum number; $\mu = -j, \dots, j$

The atomic states are referred to as  $\mathcal{N}\chi_j$ , due to the following guidelines:

$\mathcal{N}$	the principal quantum number
$\mathcal{N} = n +  \kappa $	Note that for the radial quantum number $n = 0$ , $\kappa$ is the negative integer!
$\kappa$	the Dirac quantum number; $\kappa = (l - j)(2j + 1)$
$j$	the total angular momentum quantum number; $j =  \kappa  - \frac{1}{2} = l \pm \frac{1}{2}$
$x \equiv s$	states with the orbital angular momentum quantum number $l = 0$
$x \equiv p$	states with the orbital angular momentum quantum number $l = 1$
$x \equiv d$	states with the orbital angular momentum quantum number $l = 2$

**Table 1**  
Relative dia- and paramagnetic contributions to magnetizabilities for the ground state ( $1s_{1/2}$ ) of hydrogenlike atoms, obtained with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	7.993225387407(-12)	-1.331354759680(-5)	-1.331353960358(-5)	1.000013313540(0)
2	1.279184947915(-10)	-5.326269990834(-5)	-5.326257198984(-5)	1.000053262572(0)
3	6.478143650017(-10)	-1.198729999112(-4)	-1.198723520968(-4)	1.000119872352(0)
4	2.048418388944(-9)	-2.131870673237(-4)	-2.131850189053(-4)	1.000213185019(0)
5	5.004179511809(-9)	-3.332646709060(-4)	-3.332596667264(-4)	1.000333259667(0)
6	1.038468035684(-8)	-4.801828300072(-4)	-4.801724453268(-4)	1.000480172445(0)
7	1.925647436422(-8)	-6.540359456921(-4)	-6.540166892178(-4)	1.000654016689(0)
8	3.288534421110(-8)	-8.549359618726(-4)	-8.549030765284(-4)	1.000854903077(0)
9	5.273898944038(-8)	-1.083012556972(-3)	-1.082959817983(-3)	1.001082959818(0)
10	8.049015276968(-8)	-1.338413366754(-3)	-1.338332876601(-3)	1.001338332877(0)
11	1.180201961475(-7)	-1.621304239043(-3)	-1.621186218847(-3)	1.001621186219(0)
12	1.674231392816(-7)	-1.931869521198(-3)	-1.931702098059(-3)	1.001931702098(0)
13	2.310101750929(-7)	-2.270312381279(-3)	-2.270081371104(-3)	1.002270081371(0)
14	3.113146783598(-7)	-2.636855163996(-3)	-2.636543849318(-3)	1.002636543849(0)
15	4.110977257192(-7)	-3.031739782654(-3)	-3.031328684928(-3)	1.003031328685(0)
16	5.333541472005(-7)	-3.455228148404(-3)	-3.454694794257(-3)	1.003454694794(0)
17	6.813191315903(-7)	-3.907602638308(-3)	-3.906921319177(-3)	1.003906921319(0)
18	8.584754101815(-7)	-4.389166603822(-3)	-4.388308128412(-3)	1.004388308128(0)
19	1.068561045862(-6)	-4.900244921482(-3)	-4.899176360437(-3)	1.004899176360(0)
20	1.315577857055(-6)	-5.441184587753(-3)	-5.439869009895(-3)	1.005439869010(0)
21	1.603800508770(-6)	-6.012355360154(-3)	-6.010751559645(-3)	1.006010751556(0)
22	1.937786305953(-6)	-6.614150447000(-3)	-6.612212660694(-3)	1.006612212661(0)
23	2.322385727482(-6)	-7.246987248267(-3)	-7.244664862540(-3)	1.007246648625(0)
24	2.762753742565(-6)	-7.911308150342(-3)	-7.908545396600(-3)	1.007908545397(0)
25	3.264361954924(-6)	-8.607581377638(-3)	-8.604317015683(-3)	1.008604317016(0)
26	3.833011624170(-6)	-9.336301904322(-3)	-9.332468892698(-3)	1.009332468893(0)
27	4.474847617973(-6)	-1.009799242967(-2)	-1.009351758205(-2)	1.010093517582(0)
28	5.196373353354(-6)	-1.089320442088(-2)	-1.088800804753(-2)	1.010888008048(0)
29	6.004466790399(-6)	-1.172251922749(-2)	-1.171651476070(-2)	1.011716514761(0)
30	6.906397547205(-6)	-1.258654927187(-2)	-1.257964287432(-2)	1.012579642874(0)
31	7.909845210794(-6)	-1.348593932073(-2)	-1.347802947552(-2)	1.013478029476(0)
32	9.022918925256(-6)	-1.442136784294(-2)	-1.441234492402(-2)	1.014412344924(0)
33	1.025417834541(-5)	-1.539354845931(-2)	-1.538329428096(-2)	1.015383294281(0)
34	1.161265605206(-5)	-1.640323149077(-2)	-1.639161883472(-2)	1.016391618835(0)
35	1.310788153331(-5)	-1.745120561162(-2)	-1.743809773008(-2)	1.017438097730(0)
36	1.474990684572(-5)	-1.853829961525(-2)	-1.852354970840(-2)	1.018523549708(0)
37	1.654933407918(-5)	-1.966538430043(-2)	-1.964883496635(-2)	1.019648834966(0)
38	1.851734476059(-5)	-2.083337448691(-2)	-2.081485714215(-2)	1.020814857142(0)
39	2.066573134346(-5)	-2.204323116979(-2)	-2.202256543844(-2)	1.022022565438(0)
40	2.300693094437(-5)	-2.329596382315(-2)	-2.327295689220(-2)	1.023272956892(0)
41	2.555406150152(-5)	-2.459263286429(-2)	-2.456707880279(-2)	1.024567078803(0)
42	2.832096054754(-5)	-2.593435229084(-2)	-2.590603133030(-2)	1.025906031330(0)
43	3.132222680612(-5)	-2.732229250441(-2)	-2.729097027761(-2)	1.027290970278(0)
44	3.457326484245(-5)	-2.875768333547(-2)	-2.872311007062(-2)	1.028723110071(0)
45	3.809033301923(-5)	-3.024181728570(-2)	-3.020372695269(-2)	1.030203726953(0)
46	4.189059503439(-5)	-3.177605300563(-2)	-3.173416241060(-2)	1.031734162411(0)
47	4.599217534389(-5)	-3.336181902681(-2)	-3.331582685146(-2)	1.033315826851(0)
48	5.041421880284(-5)	-3.500061777012(-2)	-3.495020355132(-2)	1.034950203551(0)
49	5.517695489177(-5)	-3.669402985361(-2)	-3.663885289872(-2)	1.036638852899(0)
50	6.030176693178(-5)	-3.844371872555(-2)	-3.838341695862(-2)	1.038383416959(0)
51	6.581126673426(-5)	-4.025143565144(-2)	-4.018562438470(-2)	1.040185624385(0)
52	7.172937517642(-5)	-4.211902508604(-2)	-4.204729571087(-2)	1.042047295711(0)
53	7.808140924641(-5)	-4.404843046531(-2)	-4.397034905606(-2)	1.043970349056(0)
54	8.489417615898(-5)	-4.604170045631(-2)	-4.595680628015(-2)	1.045956806280(0)
55	9.219607520804(-5)	-4.810099570765(-2)	-4.800879963244(-2)	1.048008799632(0)
56	1.000172080950(-4)	-5.022859614723(-2)	-5.012857893914(-2)	1.050128578939(0)
57	1.083894985542(-4)	-5.242690887955(-2)	-5.231851938100(-2)	1.052318519381(0)
58	1.173468221873(-4)	-5.469847674029(-2)	-5.458112991810(-2)	1.054581129918(0)
59	1.269251475263(-4)	-5.704598757277(-2)	-5.691906242524(-2)	1.056919062425(0)
60	1.371626894569(-4)	-5.947228429791(-2)	-5.933512160845(-2)	1.059335121608(0)
61	1.481000762720(-4)	-6.198037585788(-2)	-6.183227578161(-2)	1.061832275782(0)
62	1.597805317727(-4)	-6.457344912295(-2)	-6.441366859117(-2)	1.064413668591(0)
63	1.722500740069(-4)	-6.725488186183(-2)	-6.708263178782(-2)	1.067082631788(0)
64	1.855577324290(-4)	-7.002825688786(-2)	-6.984269915543(-2)	1.069842699155(0)
65	1.997557854872(-4)	-7.289737750736(-2)	-7.269762172188(-2)	1.072697621722(0)
66	2.149000208985(-4)	-7.586628441219(-2)	-7.565138439130(-2)	1.075651384391(0)
67	2.310500211589(-4)	-7.893927417673(-2)	-7.870822415557(-2)	1.078708224156(0)
68	2.482694771736(-4)	-8.212091954009(-2)	-8.187265006292(-2)	1.081872650063(0)
69	2.666265332680(-4)	-8.541609167830(-2)	-8.514946514504(-2)	1.085149465145(0)
70	2.861941672846(-4)	-8.882998469838(-2)	-8.854379053110(-2)	1.088543790531(0)
71	3.070506099776(-4)	-9.236814261797(-2)	-9.206109200799(-2)	1.092061092008(0)
72	3.292798085013(-4)	-9.603648913052(-2)	-9.570720932202(-2)	1.095707209322(0)
73	3.529719394731(-4)	-9.984136049844(-2)	-9.948838855896(-2)	1.099488388559(0)
74	3.782239778806(-4)	-1.037895419655(-1)	-1.034113179876(-1)	1.103411317988(0)

(continued on next page)

Table 1 (continued)

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_a/\chi$
75	4.051403290254(-4)	-1.078883081373(-1)	-1.074831678083(-1)	1.107483167808(0)
76	4.338335317732(-4)	-1.121454678452(-1)	-1.117116343134(-1)	1.111711634313(0)
77	4.644250426428(-4)	-1.165694140865(-1)	-1.161049890438(-1)	1.116104989044(0)
78	4.970461117505(-4)	-1.211691797283(-1)	-1.206721336166(-1)	1.120672133617(0)
79	5.318387633723(-4)	-1.259544997662(-1)	-1.254226610028(-1)	1.125422661003(0)
80	5.689568959565(-4)	-1.309358810604(-1)	-1.303669241644(-1)	1.130366924164(0)
81	6.085675188674(-4)	-1.361246806222(-1)	-1.355161131033(-1)	1.135516113103(0)
82	6.508521460563(-4)	-1.415331937034(-1)	-1.408823415574(-1)	1.140882341557(0)
83	6.960083703401(-4)	-1.471747531558(-1)	-1.464787447855(-1)	1.146478744785(0)
84	7.442516461343(-4)	-1.530638417862(-1)	-1.523195901401(-1)	1.152319590140(0)
85	7.958173135076(-4)	-1.592162197418(-1)	-1.584204024283(-1)	1.158420402428(0)
86	8.509629024776(-4)	-1.656490693320(-1)	-1.647981064295(-1)	1.164798106430(0)
87	9.099707638092(-4)	-1.723811601471(-1)	-1.714711893833(-1)	1.171471189383(0)
88	9.731510815115(-4)	-1.794330378837(-1)	-1.784598868022(-1)	1.178459886802(0)
89	1.040845333157(-3)	-1.868272409574(-1)	-1.857863956243(-1)	1.185786395624(0)
90	1.113430277562(-3)	-1.945885498124(-1)	-1.934751195348(-1)	1.193475119535(0)
91	1.191322565939(-3)	-2.027442748505(-1)	-2.015529522845(-1)	1.201552952285(0)
92	1.274984093171(-3)	-2.113245901714(-1)	-2.100496060783(-1)	1.210049606078(0)
93	1.364928231493(-3)	-2.203629218845(-1)	-2.189979936530(-1)	1.218997993653(0)
94	1.461727121008(-3)	-2.298964017290(-1)	-2.284346746080(-1)	1.228434674608(0)
95	1.566020232010(-3)	-2.399663992278(-1)	-2.384003789958(-1)	1.238400378996(0)
96	1.678524465558(-3)	-2.506191487587(-1)	-2.489406242931(-1)	1.248940624293(0)
97	1.800046124531(-3)	-2.619064919583(-1)	-2.601064458338(-1)	1.260106445834(0)
98	1.931495171995(-3)	-2.738867610655(-1)	-2.719552658935(-1)	1.271955265894(0)
99	2.073902303388(-3)	-2.866258355299(-1)	-2.845519332265(-1)	1.284551933226(0)
100	2.228439502290(-3)	-3.001984129893(-1)	-2.979699734870(-1)	1.297969973487(0)
101	2.396444938159(-3)	-3.146895472740(-1)	-3.122931023358(-1)	1.312293102336(0)
102	2.579453315054(-3)	-3.301965214410(-1)	-3.276170681259(-1)	1.327617068126(0)
103	2.779233116419(-3)	-3.468311444151(-1)	-3.440519112987(-1)	1.344051911299(0)
104	2.997832646188(-3)	-3.647225876705(-1)	-3.617247550243(-1)	1.361724755024(0)
105	3.237637389591(-3)	-3.840209165120(-1)	-3.807832791224(-1)	1.380783279122(0)
106	3.501442079986(-3)	-4.049015233008(-1)	-4.014000812208(-1)	1.401400081221(0)
107	3.792542067772(-3)	-4.275707439549(-1)	-4.237782018871(-1)	1.423778201887(0)
108	4.114850306397(-3)	-4.522730441566(-1)	-4.481581938502(-1)	1.448158193850(0)
109	4.473048748181(-3)	-4.793003131711(-1)	-4.748272644229(-1)	1.474827264423(0)
110	4.872786570884(-3)	-5.090040249401(-1)	-5.041312383692(-1)	1.504131238369(0)
111	5.320943060411(-3)	-5.418113563950(-1)	-5.364904133345(-1)	1.536490413335(0)
112	5.825981177812(-3)	-5.782468541442(-1)	-5.724208729663(-1)	1.572420872966(0)
113	6.398430548305(-3)	-6.189620171812(-1)	-6.125635866329(-1)	1.612563586633(0)
114	7.051558756987(-3)	-6.647763939801(-1)	-6.577248352231(-1)	1.657724835223(0)
115	7.802322592975(-3)	-7.167357931784(-1)	-7.089334705854(-1)	1.708933470585(0)
116	8.672745677533(-3)	-7.761965535868(-1)	-7.675238079093(-1)	1.767523807909(0)
117	9.691963547256(-3)	-8.449505986658(-1)	-8.352586351185(-1)	1.835258635119(0)
118	1.089934676196(-2)	-9.254163511904(-1)	-9.145170044284(-1)	1.914517004428(0)
119	1.234942911898(-2)	-1.020939910774(0)	-1.008590481655(0)	2.008590481655(0)
120	1.411998838318(-2)	-1.136288773734(0)	-1.122168785351(0)	2.122168785351(0)
121	1.632591382888(-2)	-1.278498948240(0)	-1.262173034411(0)	2.262173034411(0)
122	1.914435210472(-2)	-1.458410765526(0)	-1.439266413421(0)	2.439266413421(0)
123	2.286351365837(-2)	-1.693649393260(0)	-1.670785879601(0)	2.670785879601(0)
124	2.798595023766(-2)	-2.014931157121(0)	-1.986945206883(0)	2.986945206883(0)
125	3.547345100762(-2)	-2.481016279985(0)	-2.445542828977(0)	3.445542828977(0)
126	4.742727181095(-2)	-3.220239955450(0)	-3.172812683639(0)	4.172812683639(0)
127	6.948675269886(-2)	-4.576954603612(0)	-4.507467850913(0)	5.507467850913(0)
128	1.236943624188(-1)	-7.896965524390(0)	-7.773271161972(0)	8.773271161972(0)
129	4.671971257368(-1)	-2.887960887960(1)	-2.841241175386(1)	2.941241175386(1)
130	-2.886021555343(-1)	1.725106298974(1)	1.696246083420(1)	-1.596246083420(1)
131	-1.141973503762(-1)	6.590277294229(0)	6.476079943853(0)	-5.476079943853(0)
132	-7.266241290516(-2)	4.040141318962(0)	3.967478906057(0)	-2.967478906057(0)
133	-5.401319051565(-2)	2.885554320964(0)	2.831541130449(0)	-1.831541130449(0)
134	-4.337226713121(-2)	2.217569915068(0)	2.174197647937(0)	-1.174197647937(0)
135	-3.641222639015(-2)	1.770724396684(0)	1.734312170294(0)	-7.343121702936(-1)
136	-3.133487404024(-2)	1.432017622051(0)	1.400682748011(0)	-4.006827480105(-1)
137	-2.648578662072(-2)	1.077014262204(0)	1.050528475584(0)	-5.052847558359(-2)



**Table 2**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $2s_{1/2}$ , obtained with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	-5.709143196213(-13)	-9.509505032691(-7)	-9.509510741834(-7)	1.00000950951(0)
2	-9.135092425089(-12)	-3.804203572799(-6)	-3.804212707892(-6)	1.000003804213(0)
3	-4.625031488258(-11)	-8.560964342320(-6)	-8.561010592635(-6)	1.000008561011(0)
4	-1.461911348772(-10)	-1.522324288427(-5)	-1.522338907541(-5)	1.000015223389(0)
5	-3.569662629401(-10)	-2.379385648774(-5)	-2.379421345400(-5)	1.000023794213(0)
6	-7.403429182705(-10)	-3.427643285474(-5)	-3.427717319766(-5)	1.000034277173(0)
7	-1.371878159304(-9)	-4.667541422209(-5)	-4.667678610025(-5)	1.000046676786(0)
8	-2.340957209705(-9)	-6.099606241823(-5)	-6.099840337544(-5)	1.000060998403(0)
9	-3.750838799438(-9)	-7.724446486641(-5)	-7.724821570521(-5)	1.000077248216(0)
10	-5.718707543961(-9)	-9.542754154796(-5)	-9.543326025551(-5)	1.000095433260(0)
11	-8.375733387883(-9)	-1.155530529416(-4)	-1.155614286750(-4)	1.000115561429(0)
12	-1.186713814261(-8)	-1.376296089568(-4)	-1.376414760950(-4)	1.000137641476(0)
13	-1.635226915057(-8)	-1.616666788823(-4)	-1.616830311514(-4)	1.000161683031(0)
14	-2.200468011149(-8)	-1.876746023720(-4)	-1.876966070521(-4)	1.000187696607(0)
15	-2.901221910893(-8)	-2.156646014946(-4)	-2.156936137137(-4)	1.000215693614(0)
16	-3.757712387784(-8)	-2.456487938752(-4)	-2.456863709990(-4)	1.000245686371(0)
17	-4.791612435617(-8)	-2.776402069587(-4)	-2.776881230831(-4)	1.000277688123(0)
18	-6.026055256550(-8)	-3.116527934311(-4)	-3.117130539837(-4)	1.000311713054(0)
19	-7.485645986774(-8)	-3.477014478329(-4)	-3.47763042928(-4)	1.00034776304(0)
20	-9.196474164586(-8)	-3.858020244074(-4)	-3.858939891490(-4)	1.000385893989(0)
21	-1.118612694582(-7)	-4.259713562247(-4)	-4.260832174942(-4)	1.000426083217(0)
22	-1.348370307161(-7)	-4.682272756310(-4)	-4.683621126617(-4)	1.000468362117(0)
23	-1.611982759347(-7)	-5.125886360713(-4)	-5.127498343472(-4)	1.000512749834(0)
24	-1.912666736076(-7)	-5.590753353421(-4)	-5.592666020157(-4)	1.000559266602(0)
25	-2.253794727524(-7)	-6.077083403317(-4)	-6.079337198044(-4)	1.000607933720(0)
26	-2.638896731759(-7)	-6.585097133115(-4)	-6.587736029846(-4)	1.000658773603(0)
27	-3.071662035031(-7)	-7.115026398468(-4)	-7.118098060503(-4)	1.000711809806(0)
28	-3.555941070107(-7)	-7.667114583991(-4)	-7.670670525061(-4)	1.000767067053(0)
29	-4.095747353047(-7)	-8.241616916987(-4)	-8.245712664340(-4)	1.000824571266(0)
30	-4.695259498712(-7)	-8.838800799712(-4)	-8.843496059211(-4)	1.000884349606(0)
31	-5.358823315302(-7)	-9.458946161087(-4)	-9.464304984403(-4)	1.000946430498(0)
32	-6.090953978066(-7)	-1.010234582881(-3)	-1.010843678279(-3)	1.001010843678(0)
33	-6.89638282317(-7)	-1.076930592290(-3)	-1.077620226119(-3)	1.001077620226(0)
34	-7.779836975702(-7)	-1.146014627184(-3)	-1.146792610882(-3)	1.001146792611(0)
35	-8.746487169613(-7)	-1.217520085239(-3)	-1.218394733956(-3)	1.001218394734(0)
36	-9.801504829439(-7)	-1.291481825446(-3)	-1.292461975929(-3)	1.001292461976(0)
37	-1.095028734321(-6)	-1.367936217240(-3)	-1.369031245974(-3)	1.001369031246(0)
38	-1.219841616799(-6)	-1.446921192409(-3)	-1.448141034026(-3)	1.001448141034(0)
39	-1.355165955313(-6)	-1.528476299950(-3)	-1.529831465905(-3)	1.001529831466(0)
40	-1.501597533930(-6)	-1.612642764038(-3)	-1.614144361572(-3)	1.001614144362(0)
41	-1.659751383183(-6)	-1.699463545291(-3)	-1.701123296674(-3)	1.001701123297(0)
42	-1.830262074667(-6)	-1.788983405519(-3)	-1.790813667594(-3)	1.001790813668(0)
43	-2.013784022681(-6)	-1.881248976188(-3)	-1.883262760210(-3)	1.001883262760(0)
44	-2.210991792663(-6)	-1.976308830793(-3)	-1.978519822585(-3)	1.001978519823(0)
45	-2.422580416118(-6)	-2.074213561418(-3)	-2.076636141834(-3)	1.002076636142(0)
46	-2.649265711682(-6)	-2.175015859719(-3)	-2.177665125431(-3)	1.002177665125(0)
47	-2.891784611900(-6)	-2.278770602624(-3)	-2.281662387236(-3)	1.002281662387(0)
48	-3.150895495230(-6)	-2.385534943055(-3)	-2.388685838550(-3)	1.002388685839(0)
49	-3.427378522723(-6)	-2.495368405998(-3)	-2.498795784521(-3)	1.002498795785(0)
50	-3.722035978698(-6)	-2.608332990275(-3)	-2.612055026254(-3)	1.002612055026(0)
51	-4.035692614682(-6)	-2.724493276406(-3)	-2.728528969021(-3)	1.002728528969(0)
52	-4.369195995740(-6)	-2.843916540967(-3)	-2.848285736963(-3)	1.002848285737(0)
53	-4.723416848203(-6)	-2.966672877907(-3)	-2.971396294755(-3)	1.002971396295(0)
54	-5.099249407656(-6)	-3.092835327293(-3)	-3.097934576701(-3)	1.003097934577(0)
55	-5.497611765905(-6)	-3.222480012025(-3)	-3.227977623791(-3)	1.003227977624(0)
56	-5.919446215427(-6)	-3.355686283081(-3)	-3.361605729296(-3)	1.003361605729(0)
57	-6.365719589637(-6)	-3.492536873921(-3)	-3.498902593511(-3)	1.003498902594(0)
58	-6.837423597059(-6)	-3.633118064721(-3)	-3.639955488318(-3)	1.003639955488(0)
59	-7.335575147225(-6)	-3.777519857168(-3)	-3.784855432315(-3)	1.003784855432(0)
60	-7.861216665841(-6)	-3.925836160621(-3)	-3.933697377287(-3)	1.003933697377(0)
61	-8.415416396434(-6)	-4.078164990506(-3)	-4.086580406902(-3)	1.004086580407(0)
62	-8.999268685294(-6)	-4.234608679892(-3)	-4.243607948578(-3)	1.004243607949(0)
63	-9.613894246136(-6)	-4.395274105298(-3)	-4.404887999544(-3)	1.004404888000(0)
64	-1.026044040040(-5)	-4.560272927845(-3)	-4.570533368245(-3)	1.004570533368(0)
65	-1.094008128858(-5)	-4.729721851021(-3)	-4.740661932310(-3)	1.004740661932(0)
66	-1.165401804736(-5)	-4.903742896401(-3)	-4.915396914449(-3)	1.004915396914(0)
67	-1.240347894662(-5)	-5.082463698826(-3)	-5.094867177772(-3)	1.005094867178(0)
68	-1.318971947961(-5)	-5.266017822677(-3)	-5.279207542157(-3)	1.005279207542(0)
69	-1.401402239871(-5)	-5.454545101064(-3)	-5.468559123462(-3)	1.005468559123(0)
70	-1.487769768804(-5)	-5.648191999890(-3)	-5.663069697578(-3)	1.005663069698(0)
71	-1.578208246321(-5)	-5.847112009023(-3)	-5.862894091487(-3)	1.005862894091(0)
72	-1.672854078714(-5)	-6.051466062960(-3)	-6.068194603747(-3)	1.006068194604(0)
73	-1.771846338911(-5)	-6.261422993686(-3)	-6.279141457075(-3)	1.006279141457(0)
74	-1.875326727286(-5)	-6.477160018695(-3)	-6.495913285967(-3)	1.006495913286(0)

(continued on next page)



Table 2 (continued)

Z	$\chi_p'/X$	$\chi_p''/X$	$\chi_p/X$	$\chi_a/X$
75	-1.983439519733(-5)	-6.698863267445(-3)	-6.718697662642(-3)	1.006718697663(0)
76	-2.096331501130(-5)	-6.926728349928(-3)	-6.947691664939(-3)	1.006947691665(0)
77	-2.214151882096(-5)	-7.160960971407(-3)	-7.183102490228(-3)	1.007183102490(0)
78	-2.337052196585(-5)	-7.401777597859(-3)	-7.425148119825(-3)	1.007425148120(0)
79	-2.465186177578(-5)	-7.649406177186(-3)	-7.674058038962(-3)	1.007674058039(0)
80	-2.598709607691(-5)	-7.904086921860(-3)	-7.930074017937(-3)	1.007930074018(0)
81	-2.737780141077(-5)	-8.166073159333(-3)	-8.193450960743(-3)	1.008193450961(0)
82	-2.882557092471(-5)	-8.435632257350(-3)	-8.464457828275(-3)	1.008464457828(0)
83	-3.033201188587(-5)	-8.713046632156(-3)	-8.743378644042(-3)	1.008743378644(0)
84	-3.189874276397(-5)	-8.998614848627(-3)	-9.030513591391(-3)	1.009030513591(0)
85	-3.352738981950(-5)	-9.292652822521(-3)	-9.326180212340(-3)	1.009326180212(0)
86	-3.521958312425(-5)	-9.595495136378(-3)	-9.630714719503(-3)	1.009630714720(0)
87	-3.697695193002(-5)	-9.907496482150(-3)	-9.944473434080(-3)	1.009944473434(0)
88	-3.880111928733(-5)	-1.022903324543(-2)	-1.026783436472(-2)	1.010267834365(0)
89	-4.069369580107(-5)	-1.056050524824(-2)	-1.060119894404(-2)	1.010601198944(0)
90	-4.265627239076(-5)	-1.090233766974(-2)	-1.094499394213(-2)	1.010944993942(0)
91	-4.469041190168(-5)	-1.125498316698(-2)	-1.129967357888(-2)	1.011299673579(0)
92	-4.679763938710(-5)	-1.161892422134(-2)	-1.166572186072(-2)	1.011665721861(0)
93	-4.897943085089(-5)	-1.199467573970(-2)	-1.204365517055(-2)	1.012043655171(0)
94	-5.123720020325(-5)	-1.238278794462(-2)	-1.243402514482(-2)	1.012434025145(0)
95	-5.357228413837(-5)	-1.278384959239(-2)	-1.283742187653(-2)	1.012837421877(0)
96	-5.598592458977(-5)	-1.319849156498(-2)	-1.325447748957(-2)	1.013254477490(0)
97	-5.847924835608(-5)	-1.362739088889(-2)	-1.368587013724(-2)	1.013685870137(0)
98	-6.105324341291(-5)	-1.407127524323(-2)	-1.413232848665(-2)	1.014132328487(0)
99	-6.370873133311(-5)	-1.453092803050(-2)	-1.459463676183(-2)	1.014594636762(0)
100	-6.644633512472(-5)	-1.500719409599(-2)	-1.507364043111(-2)	1.015073640431(0)
101	-6.926644165615(-5)	-1.550098619843(-2)	-1.557025264008(-2)	1.015570252640(0)
102	-7.216915766756(-5)	-1.601329235314(-2)	-1.608546151081(-2)	1.016085461511(0)
103	-7.515425815608(-5)	-1.654518419308(-2)	-1.662033845124(-2)	1.016620338451(0)
104	-7.822112565957(-5)	-1.709782652186(-2)	-1.717604764752(-2)	1.017176047648(0)
105	-8.136867863644(-5)	-1.767248826894(-2)	-1.775385694758(-2)	1.017753856948(0)
106	-8.459528672649(-5)	-1.827055510179(-2)	-1.835515038851(-2)	1.018355150389(0)
107	-8.789867015800(-5)	-1.889354400546(-2)	-1.898144267562(-2)	1.018981442676(0)
108	-9.127577990367(-5)	-1.954312021075(-2)	-1.963439599065(-2)	1.019634395991(0)
109	-9.472265434076(-5)	-2.022111694078(-2)	-2.031583959512(-2)	1.020315839595(0)
110	-9.823424707643(-5)	-2.092955856029(-2)	-2.102779280736(-2)	1.021027792807(0)
111	-1.018042191772(-4)	-2.167068785842(-2)	-2.177249207760(-2)	1.021772492078(0)
112	-1.054246871764(-4)	-2.244699838666(-2)	-2.255242307384(-2)	1.022552423074(0)
113	-1.090859157646(-4)	-2.326127302354(-2)	-2.337035893930(-2)	1.023370358939(0)
114	-1.127759407734(-4)	-2.411663026879(-2)	-2.422940620956(-2)	1.024229406210(0)
115	-1.164801036079(-4)	-2.501658021269(-2)	-2.513306031630(-2)	1.025133060316(0)
116	-1.201804722098(-4)	-2.596509272569(-2)	-2.608527319790(-2)	1.026085273198(0)
117	-1.238551152311(-4)	-2.696668123519(-2)	-2.709053635042(-2)	1.027090536350(0)
118	-1.274771843322(-4)	-2.802650659718(-2)	-2.815398378151(-2)	1.028153983782(0)
119	-1.310137427990(-4)	-2.915050717871(-2)	-2.928152092151(-2)	1.029281520922(0)
120	-1.344242545220(-4)	-3.034556357064(-2)	-3.047998782516(-2)	1.030479987825(0)
121	-1.376586118935(-4)	-3.161970970820(-2)	-3.175736832010(-2)	1.031757368320(0)
122	-1.406545279842(-4)	-3.298240716997(-2)	-3.312306169795(-2)	1.033123061698(0)
123	-1.433340369006(-4)	-3.444490701340(-2)	-3.458824105030(-2)	1.034588241050(0)
124	-1.455987183785(-4)	-3.602073532097(-2)	-3.616633403935(-2)	1.036166334039(0)
125	-1.473230564577(-4)	-3.772635754655(-2)	-3.787368060301(-2)	1.037873680603(0)
126	-1.483449988777(-4)	-3.958210799923(-2)	-3.973045299811(-2)	1.039730452998(0)
127	-1.484521917260(-4)	-4.161352431764(-2)	-4.176197650937(-2)	1.041761976509(0)
128	-1.473612987021(-4)	-4.385332236606(-2)	-4.400068366476(-2)	1.044000683665(0)
129	-1.446858014455(-4)	-4.634442632311(-2)	-4.648911212456(-2)	1.046489112125(0)
130	-1.398836422235(-4)	-4.914482572747(-2)	-4.928470936969(-2)	1.049284709370(0)
131	-1.321673764618(-4)	-5.233579507865(-2)	-5.246796245511(-2)	1.052467962455(0)
132	-1.203389979337(-4)	-5.603680078457(-2)	-5.615713978250(-2)	1.056157139783(0)
133	-1.024572038869(-4)	-6.043513434026(-2)	-6.053759154414(-2)	1.060537591544(0)
134	-7.507539135388(-5)	-6.585289744582(-2)	-6.592797283717(-2)	1.065927972837(0)
135	-3.111842488788(-5)	-7.293124915285(-2)	-7.296236757773(-2)	1.072962367578(0)
136	4.854711576328(-5)	-8.335223861232(-2)	-8.330369149655(-2)	1.083303691497(0)
137	3.157064194156(-4)	-1.099754480747(-1)	-1.096597416553(-1)	1.109659741655(0)



**Table 3**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $2p_{1/2}$ , obtained with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	1.000074890026(0)	3.323431213802(-11)	1.000074890060(0)	-7.489005955767(-5)
2	1.000299623832(0)	5.319109788891(-10)	1.000299624364(0)	-2.996243641131(-4)
3	1.000674392738(0)	2.694166981127(-9)	1.000674395432(0)	-6.743954318263(-4)
4	1.001199516074(0)	8.520955556455(-9)	1.001199524595(0)	-1.199524595252(-3)
5	1.001875441885(0)	2.082215337109(-8)	1.001875462707(0)	-1.875462706807(-3)
6	1.002702747905(0)	4.322515023852(-8)	1.002702791130(0)	-2.702791130493(-3)
7	1.003682142838(0)	8.018596139738(-8)	1.003682223024(0)	-3.682223024007(-3)
8	1.004814467914(0)	1.370029142747(-7)	1.004814604917(0)	-4.814604916545(-3)
9	1.006100698756(0)	2.198329739423(-7)	1.006100918589(0)	-6.100918588908(-3)
10	1.007541947553(0)	3.357107842120(-7)	1.007542283264(0)	-7.542283263792(-3)
11	1.009139465545(0)	4.925705146067(-7)	1.009139958116(0)	-9.139958115511(-3)
12	1.010894645839(0)	6.992706173824(-7)	1.010895345110(0)	-1.875462706807(-2)
13	1.012809026564(0)	9.656216134742(-7)	1.012809992186(0)	-1.280999218597(-2)
14	1.014884294378(0)	1.302417041811(-6)	1.014885596795(0)	-1.488559679481(-2)
15	1.017122288340(0)	1.721467722998(-6)	1.017124009808(0)	-1.712400980821(-2)
16	1.019525004178(0)	2.235639506079(-6)	1.019527239817(0)	-1.952723981712(-2)
17	1.022094598943(0)	2.858894686017(-6)	1.022097457837(0)	-2.209745783730(-2)
18	1.024833396107(0)	3.606337300003(-6)	1.024837002444(0)	-2.483700244390(-2)
19	1.027743891096(0)	4.494262532630(-6)	1.027748385358(0)	-2.774838535816(-2)
20	1.030828757302(0)	5.540210483888(-6)	1.030834297512(0)	-3.083429751207(-2)
21	1.034090852595(0)	6.763024579693(-6)	1.034097615619(0)	-3.409761561917(-2)
22	1.037533226368(0)	8.182914932833(-6)	1.037541409283(0)	-3.754140928267(-2)
23	1.041159127148(0)	9.821526992809(-6)	1.041168948675(0)	-4.116894867489(-2)
24	1.044972010810(0)	1.170201585652(-5)	1.044983712826(0)	-4.498371282558(-2)
25	1.048975549433(0)	1.384912664835(-5)	1.048989398560(0)	-4.898939856003(-2)
26	1.053173640851(0)	1.628928141830(-5)	1.053189930132(0)	-5.318993013203(-2)
27	1.057570418928(0)	1.905067305100(-5)	1.057589469601(0)	-5.758946960089(-2)
28	1.062170264640(0)	2.216336672674(-5)	1.062192428007(0)	-6.219242800665(-2)
29	1.066977817993(0)	2.565940952912(-5)	1.067003477403(0)	-6.700347740268(-2)
30	1.071997990862(0)	2.957294885302(-5)	1.072027563811(0)	-7.202756381074(-2)
31	1.077235980809(0)	3.394036033128(-5)	1.077269921170(0)	-7.726992116972(-2)
32	1.082697285970(0)	3.880038607099(-5)	1.082736086357(0)	-8.273608635652(-2)
33	1.088387721081(0)	4.419428406972(-5)	1.088431915365(0)	-8.843191536508(-2)
34	1.094313434748(0)	5.016598977092(-5)	1.094363600738(0)	-9.436360073817(-2)
35	1.100480928065(0)	5.676229081581(-5)	1.100537690356(0)	-1.005376903562(-1)
36	1.106897074681(0)	6.403301615908(-5)	1.106961107697(0)	-1.106961107697(-1)
37	1.113569142456(0)	7.203124083726(-5)	1.113641173697(0)	-1.136411736967(-1)
38	1.120504816834(0)	8.081350781535(-5)	1.120585630342(0)	-1.205856303415(-1)
39	1.127712226091(0)	9.044006848904(-5)	1.127802666160(0)	-1.278026661598(-1)
40	1.135199968626(0)	1.009751435907(-4)	1.135300943770(0)	-1.353009437700(-1)
41	1.142977142476(0)	1.124872064377(-4)	1.143089629682(0)	-1.430896296824(-1)
42	1.151053377269(0)	1.250492906767(-4)	1.151178426560(0)	-1.511784265598(-1)
43	1.159438868846(0)	1.387393249173(-4)	1.159577608171(0)	-1.595776081713(-1)
44	1.168144416799(0)	1.536404969207(-4)	1.168298057295(0)	-1.682980572954(-1)
45	1.177181465211(0)	1.698416503150(-4)	1.177351306861(0)	-1.773513068609(-1)
46	1.186562146927(0)	1.874377171523(-4)	1.186749584644(0)	-1.867495846442(-1)
47	1.196299331691(0)	2.065301900160(-4)	1.196505861881(0)	-1.965058618808(-1)
48	1.206406678551(0)	2.272276378275(-4)	1.206633906189(0)	-2.066339061890(-1)
49	1.216898692982(0)	2.496462700059(-4)	1.217148339252(0)	-2.171483392523(-1)
50	1.22790789207(0)	2.739105542032(-4)	1.228064699761(0)	-2.280646997608(-1)
51	1.239099358280(0)	3.001538934921(-4)	1.239399512173(0)	-2.393995121732(-1)
52	1.250841842561(0)	3.285193696231(-4)	1.251170361931(0)	-2.511703619307(-1)
53	1.263036817275(0)	3.591605598203(-4)	1.263395977834(0)	-2.633959778344(-1)
54	1.275704079954(0)	3.922424355572(-4)	1.276096322390(0)	-2.760963223897(-1)
55	1.288864748672(0)	4.279423528730(-4)	1.289292691025(0)	-2.892926910251(-1)
56	1.302541370069(0)	4.664511450753(-4)	1.303007821214(0)	-3.030078212140(-1)
57	1.316758038337(0)	5.079743301600(-4)	1.317266012668(0)	-3.172660126676(-1)
58	1.331540526479(0)	5.527334469909(-4)	1.332093259926(0)	-3.320932599260(-1)
59	1.346916431325(0)	6.009675362711(-4)	1.347517398862(0)	-3.475173988615(-1)
60	1.362915334039(0)	6.529347846402(-4)	1.363568268823(0)	-3.635682688232(-1)
61	1.379568978048(0)	7.089143529183(-4)	1.380277892401(0)	-3.802778924009(-1)
62	1.396911466669(0)	7.692084126474(-4)	1.397680675081(0)	-3.976806750814(-1)
63	1.414979482989(0)	8.341444187492(-4)	1.415813627407(0)	-4.158136274075(-1)
64	1.433812535004(0)	9.040776504138(-4)	1.434716612654(0)	-4.347166126543(-1)
65	1.453453229447(0)	9.793940573981(-4)	1.454432623504(0)	-4.544326235043(-1)
66	1.473947578305(0)	1.060513454880(-3)	1.475008091759(0)	-4.750080917594(-1)
67	1.495345342667(0)	1.147893117087(-3)	1.496493235784(0)	-4.964932357842(-1)
68	1.517700419323(0)	1.242031828299(-3)	1.518942451152(0)	-5.189424511516(-1)
69	1.541071276432(0)	1.343474459855(-3)	1.542414750892(0)	-5.424147508918(-1)
70	1.565521445695(0)	1.452817153697(-3)	1.566974262849(0)	-5.669742628490(-1)
71	1.591120079775(0)	1.570713207387(-3)	1.592690792983(0)	-5.926907929826(-1)
72	1.617942585271(0)	1.697879772768(-3)	1.619640465043(0)	-6.196404650435(-1)
73	1.646071343490(0)	1.835105501327(-3)	1.647906448991(0)	-6.479064489909(-1)
74	1.675596533559(0)	1.983259294690(-3)	1.677579792853(0)	-6.775797928534(-1)

(continued on next page)

Table 3 (continued)

Z	$X_p'/X$	$X_p''/X$	$X_p/X$	$X_a/X$
75	1.706617075246(0)	2.143300349557(-3)	1.708760375596(0)	-7.087603755960(-1)
76	1.739241712321(0)	2.316289724234(-3)	1.741558002045(0)	-7.415580020451(-1)
77	1.773590261518(0)	2.503403700465(-3)	1.776093665218(0)	-7.760936652180(-1)
78	1.809795057440(0)	2.705949271791(-3)	1.812501006712(0)	-8.125010067117(-1)
79	1.848002630229(0)	2.925382161148(-3)	1.850928012391(0)	-8.509280123906(-1)
80	1.888375660983(0)	3.163327859700(-3)	1.891538988843(0)	-8.915389888431(-1)
81	1.931095270115(0)	3.421606291027(-3)	1.934516876406(0)	-9.345168764060(-1)
82	1.976363706753(0)	3.702260846520(-3)	1.980065967600(0)	-9.800659675995(-1)
83	2.024407523686(0)	4.007592717943(-3)	2.028415116404(0)	-1.028415116404(0)
84	2.075481343337(0)	4.340201683757(-3)	2.079821545020(0)	-1.079821545020(0)
85	2.129872347291(0)	4.703034802877(-3)	2.134575382094(0)	-1.134575382094(0)
86	2.187905657005(0)	5.099444855390(-3)	2.193005101861(0)	-1.193005101861(0)
87	2.249950819214(0)	5.533260874478(-3)	2.255484080088(0)	-1.255484080088(0)
88	2.316429670115(0)	6.008873779837(-3)	2.322438543894(0)	-1.322438543894(0)
89	2.387825932999(0)	6.531341009331(-3)	2.394357274009(0)	-1.394357274009(0)
90	2.464697012251(0)	7.106515236778(-3)	2.471803527488(0)	-1.471803527488(0)
91	2.547688593543(0)	7.741203880491(-3)	2.555429797423(0)	-1.555429797423(0)
92	2.637552861608(0)	8.443368325348(-3)	2.645996229933(0)	-1.645996229933(0)
93	2.735171426655(0)	9.222374860032(-3)	2.744393801515(0)	-1.744393801515(0)
94	2.841584443548(0)	1.008931365830(-2)	2.851673757206(0)	-1.851673757206(0)
95	2.958027967754(0)	1.105740829757(-2)	2.969085376051(0)	-1.969085376051(0)
96	3.085982401330(0)	1.214254721912(-2)	3.098124948549(0)	-2.098124948549(0)
97	3.227236070683(0)	1.336398162218(-2)	3.240600052305(0)	-2.240600052305(0)
98	3.383969753904(0)	1.474525384345(-2)	3.398715007747(0)	-2.398715007747(0)
99	3.558870680526(0)	1.631545006638(-2)	3.575186130593(0)	-2.575186130593(0)
100	3.755288733967(0)	1.811091754549(-2)	3.773399651512(0)	-2.773399651512(0)
101	3.977454284718(0)	2.017766030416(-2)	3.997631945022(0)	-2.997631945022(0)
102	4.230788023710(0)	2.257474778317(-2)	4.253362771494(0)	-3.253362771494(0)
103	4.522351563814(0)	2.537927358081(-2)	4.547730837395(0)	-3.547730837395(0)
104	4.861519543117(0)	2.869375354097(-2)	4.890213296658(0)	-3.890213296658(0)
105	5.261011604536(0)	3.265748739504(-2)	5.293669091931(0)	-4.293669091931(0)
106	5.738531102127(0)	3.746460310178(-2)	5.775995705229(0)	-4.775995705229(0)
107	6.319471920592(0)	4.339386631798(-2)	6.362865786910(0)	-5.362865786910(0)
108	7.041604654956(0)	5.086029303393(-2)	7.092464947990(0)	-6.092464947990(0)
109	7.963665196704(0)	6.050974929129(-2)	8.024174945995(0)	-7.024174945995(0)
110	9.182248141083(0)	7.340503444177(-2)	9.255653175525(0)	-8.255653175525(0)
111	1.086817393243(1)	9.142648379182(-2)	1.095960041622(1)	-9.959600416223(0)
112	1.335474774835(1)	1.182442052808(-1)	1.347299195364(1)	-1.247299195364(1)
113	1.739124797578(1)	1.621104739860(-1)	1.755335844977(1)	-1.655335844977(1)
114	2.508619478263(1)	2.462507072859(-1)	2.533244548992(1)	-2.433244548992(1)
115	4.554759063676(1)	4.709960565894(-1)	4.601858669335(1)	-4.501858669335(1)
116	2.656447288014(2)	2.894887420381(0)	2.685396162218(2)	-2.675396162218(2)
117	-6.791511219956(1)	-7.803151696928(-1)	-6.869542736925(1)	6.969542736925(1)
118	-2.982588983562(1)	-3.614870124267(-1)	-3.018737684805(1)	3.118737684805(1)
119	-1.898765813661(1)	-2.428959542888(-1)	-1.923055409090(1)	2.023055409090(1)
120	-1.385810718557(1)	-1.872370815011(-1)	-1.404534426707(1)	1.504534426707(1)
121	-1.086534158027(1)	-1.551673921564(-1)	-1.102050897242(1)	1.202050897242(1)
122	-8.902907732784(0)	-1.345039014812(-1)	-9.037411634265(0)	1.003741163426(1)
123	-7.515640978911(0)	-1.202392230510(-1)	-7.635880201962(0)	8.635880201962(0)
124	-6.481898592276(0)	-1.099397400467(-1)	-6.591838332322(0)	7.591838332322(0)
125	-5.680791339788(0)	-1.022834057574(-1)	-5.783074745545(0)	6.783074745545(0)
126	-5.040739135272(0)	-9.649355231112(-2)	-5.137232687583(0)	6.137232687583(0)
127	-4.516614799447(0)	-9.208784638456(-2)	-4.608702645831(0)	5.608702645831(0)
128	-4.078507064196(0)	-8.875559109208(-2)	-4.167262655288(0)	5.167262655288(0)
129	-3.705741733772(0)	-8.629352415779(-2)	-3.792035257929(0)	4.792035257929(0)
130	-3.383485401826(0)	-8.457105234768(-2)	-3.468056454174(0)	4.468056454174(0)
131	-3.100696091855(0)	-8.351213135130(-2)	-3.184208223207(0)	4.184208223207(0)
132	-2.848796230779(0)	-8.308868025899(-2)	-2.931884911038(0)	3.931884911038(0)
133	-2.620704478985(0)	-8.332578595180(-2)	-2.704030264937(0)	3.704030264937(0)
134	-2.409920812250(0)	-8.432726190009(-2)	-2.494248074150(0)	3.494248074150(0)
135	-2.209099959021(0)	-8.635726025060(-2)	-2.295457219271(0)	3.295457219271(0)
136	-2.005598901727(0)	-9.016945255827(-2)	-2.095768354285(0)	3.095768354285(0)
137	-1.721726523137(0)	-1.015916589665(-1)	-1.823318182103(0)	2.823318182103(0)



**Table 4**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $2p_{3/2}$  ( $\mu = \pm 1/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	9.999400944725(-1)	-6.646019615265(-11)	9.999400944060(-1)	5.990559400935(-5)
2	9.997604048392(-1)	-1.063282473528(-9)	9.997604037760(-1)	2.395962240474(-4)
3	9.994610119036(-1)	-5.382187296677(-9)	9.994610065214(-1)	5.389934785563(-4)
4	9.990420501878(-1)	-1.700736249134(-8)	9.990420331804(-1)	9.579668195500(-4)
5	9.985037077083(-1)	-4.151245218696(-8)	9.985036661958(-1)	1.496333804192(-3)
6	9.978462256620(-1)	-8.605635804056(-8)	9.978461396057(-1)	2.153860394331(-3)
7	9.970698980245(-1)	-1.593778693858(-7)	9.970697386467(-1)	2.930261353320(-3)
8	9.961750710599(-1)	-2.717891436200(-7)	9.961747992707(-1)	3.825200729271(-3)
9	9.951621427444(-1)	-4.351680627472(-7)	9.951617075763(-1)	4.838292423700(-3)
10	9.940315621051(-1)	-6.629494965253(-7)	9.940308991557(-1)	5.969100844349(-3)
11	9.927838284747(-1)	-9.701155071018(-7)	9.927828583592(-1)	7.217141640811(-3)
12	9.914194906631(-1)	-1.373184534367(-6)	9.9141811174786(-1)	8.581882521390(-3)
13	9.899391460501(-1)	-1.890199605470(-6)	9.899372558505(-1)	1.006274414951(-2)
14	9.883434395978(-1)	-2.540715616066(-6)	9.883408988822(-1)	1.165910111781(-2)
15	9.866330627878(-1)	-3.345785734813(-6)	9.866297170020(-1)	1.337028299795(-2)
16	9.848087524830(-1)	-4.327946986492(-6)	9.848044245360(-1)	1.519557546398(-2)
17	9.828712897180(-1)	-5.511205072816(-6)	9.828657785130(-1)	1.713422148702(-2)
18	9.808214984194(-1)	-6.921018493508(-6)	9.808145774009(-1)	1.918542259906(-2)
19	9.786602440589(-1)	-8.584282033655(-6)	9.786516597769(-1)	2.134834022312(-2)
20	9.763884322421(-1)	-1.052930968653(-5)	9.763779029324(-1)	2.362209706762(-2)
21	9.740070072350(-1)	-1.278581708419(-5)	9.739942214179(-1)	2.600577858206(-2)
22	9.715169504320(-1)	-1.538490351099(-5)	9.715015655284(-1)	2.849843447155(-2)
23	9.689192787662(-1)	-1.835903357810(-5)	9.689009197326(-1)	3.109908026736(-2)
24	9.662150430678(-1)	-2.174201863935(-5)	9.661933010491(-1)	3.380669895086(-2)
25	9.634053263700(-1)	-2.556899803167(-5)	9.633797573720(-1)	3.662024262801(-2)
26	9.604912421685(-1)	-2.987642022526(-5)	9.604613657483(-1)	3.953863425173(-2)
27	9.574739326346(-1)	-3.470202397109(-5)	9.574392306107(-1)	4.256076938933(-2)
28	9.543545667872(-1)	-4.008481953525(-5)	9.543144819676(-1)	4.568551803235(-2)
29	9.511343386241(-1)	-4.606507011167(-5)	9.510882735540(-1)	4.891172644603(-2)
30	9.478144652176(-1)	-5.268427350660(-5)	9.477617809441(-1)	5.223821905592(-2)
31	9.443961847752(-1)	-5.998514418993(-5)	9.443361996311(-1)	5.566380036895(-2)
32	9.408807546693(-1)	-6.801159581015(-5)	9.408127430735(-1)	5.918725692655(-2)
33	9.372694494369(-1)	-7.680872427157(-5)	9.371926407126(-1)	6.280735928739(-2)
34	9.335635587539(-1)	-8.642279147372(-5)	9.334771359625(-1)	6.652286403754(-2)
35	9.297643853840(-1)	-9.690120981480(-5)	9.296674841741(-1)	7.033251582585(-2)
36	9.258732431050(-1)	-1.082925275625(-4)	9.257649505775(-1)	7.423504942254(-2)
37	9.218914546160(-1)	-1.206464151974(-4)	9.217708082008(-1)	7.822919179923(-2)
38	9.178203494242(-1)	-1.340136528353(-4)	9.176863357713(-1)	8.231366422865(-2)
39	9.136612617162(-1)	-1.484461188384(-4)	9.135128155974(-1)	8.648718440261(-2)
40	9.094155282128(-1)	-1.639967797244(-4)	9.092515314331(-1)	9.074846856688(-2)
41	9.050844860095(-1)	-1.807196814880(-4)	9.049037663281(-1)	9.509623367195(-2)
42	9.006694704036(-1)	-1.986699424496(-4)	9.004708004612(-1)	9.952919953885(-2)
43	8.961718127084(-1)	-2.179037477489(-4)	8.959539089606(-1)	1.040460910394(-1)
44	8.915928380552(-1)	-2.384783456053(-4)	8.913543597096(-1)	1.086456402904(-1)
45	8.869338631830(-1)	-2.604520454695(-4)	8.866734111376(-1)	1.133265888624(-1)
46	8.821961942160(-1)	-2.838842181930(-4)	8.819123099978(-1)	1.180876900022(-1)
47	8.773811244279(-1)	-3.088352983507(-4)	8.770722891296(-1)	1.229277108704(-1)
48	8.724899319936(-1)	-3.353667888513(-4)	8.721545652048(-1)	1.278454347952(-1)
49	8.675238777251(-1)	-3.635412679796(-4)	8.671603364571(-1)	1.328396635429(-1)
50	8.624842027919(-1)	-3.934223990187(-4)	8.620907803929(-1)	1.379092196071(-1)
51	8.573721264234(-1)	-4.250749426084(-4)	8.569470514808(-1)	1.430529485192(-1)
52	8.521888435904(-1)	-4.585647720023(-4)	8.517302788184(-1)	1.482697211816(-1)
53	8.469355226634(-1)	-4.939588913950(-4)	8.464415637720(-1)	1.535584362280(-1)
54	8.416133030445(-1)	-5.313254575032(-4)	8.410819775870(-1)	1.589180224130(-1)
55	8.362232927690(-1)	-5.707338045900(-4)	8.356525589645(-1)	1.643474410355(-1)
56	8.307665660722(-1)	-6.122544731395(-4)	8.301543115990(-1)	1.698456884010(-1)
57	8.252441609158(-1)	-6.559592423993(-4)	8.245882016734(-1)	1.754117983266(-1)
58	8.196570764700(-1)	-7.019211670244(-4)	8.189551553030(-1)	1.810448446970(-1)
59	8.140062705431(-1)	-7.502146180736(-4)	8.132560559250(-1)	1.867439440750(-1)
60	8.082926569522(-1)	-8.009153286290(-4)	8.074917416236(-1)	1.925082583764(-1)
61	8.025171028277(-1)	-8.541004443296(-4)	8.016630023834(-1)	1.983369976166(-1)
62	7.966804258416(-1)	-9.098485791356(-4)	7.957705772624(-1)	2.042294227376(-1)
63	7.907833913500(-1)	-9.682398766659(-4)	7.898151514733(-1)	2.101848485267(-1)
64	7.848267094404(-1)	-1.029356077482(-3)	7.837973533629(-1)	2.162026466371(-1)
65	7.788110318692(-1)	-1.093280592724(-3)	7.777177512764(-1)	2.222822487236(-1)
66	7.727369488774(-1)	-1.160098584549(-3)	7.715768502928(-1)	2.284231497072(-1)
67	7.666049858702(-1)	-1.229897053849(-3)	7.653750888164(-1)	2.346249111836(-1)
68	7.604155999423(-1)	-1.302764935793(-3)	7.591128350065(-1)	2.408871649935(-1)
69	7.541691762319(-1)	-1.378793203780(-3)	7.527903830281(-1)	2.472096169719(-1)
70	7.478660240824(-1)	-1.458074982448(-3)	7.464079490999(-1)	2.535920509001(-1)
71	7.415063729900(-1)	-1.540705670456(-3)	7.399656673195(-1)	2.600343326805(-1)
72	7.350903683113(-1)	-1.626783073841(-3)	7.334635852375(-1)	2.665364147625(-1)
73	7.286180667038(-1)	-1.716407550811(-3)	7.269016591530(-1)	2.730983408470(-1)
74	7.220894312673(-1)	-1.809682168972(-3)	7.202797490983(-1)	2.797202509017(-1)

(continued on next page)

Table 4 (continued)

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
75	7.155043263530(-1)	-1.906712876056(-3)	7.135976134769(-1)	2.864023865231(-1)
76	7.088625120007(-1)	-2.007608685373(-3)	7.068549033154(-1)	2.931450966846(-1)
77	7.021636379614(-1)	-2.112481877333(-3)	7.000511560840(-1)	2.999488439160(-1)
78	6.954072372557(-1)	-2.221448218551(-3)	6.931857890372(-1)	3.068142109628(-1)
79	6.885927192166(-1)	-2.334627200235(-3)	6.862580920163(-1)	3.137419079837(-1)
80	6.817193619514(-1)	-2.452142297758(-3)	6.792672196536(-1)	3.207327803464(-1)
81	6.747863041585(-1)	-2.574121253557(-3)	6.722121829050(-1)	3.277878170950(-1)
82	6.677925362174(-1)	-2.700696385783(-3)	6.650918398316(-1)	3.349081601684(-1)
83	6.607368904664(-1)	-2.832004925427(-3)	6.579048855410(-1)	3.420951144590(-1)
84	6.536180305673(-1)	-2.968189385024(-3)	6.506498411822(-1)	3.493501588178(-1)
85	6.464344398440(-1)	-3.109397962444(-3)	6.433250418815(-1)	3.566749581185(-1)
86	6.391844084654(-1)	-3.255784983776(-3)	6.359286234816(-1)	3.640713765184(-1)
87	6.318660193253(-1)	-3.407511389864(-3)	6.284585079354(-1)	3.715414920646(-1)
88	6.244771324492(-1)	-3.564745271706(-3)	6.209123871775(-1)	3.790876128225(-1)
89	6.170153677351(-1)	-3.727662460714(-3)	6.132877052744(-1)	3.867122947256(-1)
90	6.094780858022(-1)	-3.896447180695(-3)	6.055816386215(-1)	3.944183613785(-1)
91	6.018623666908(-1)	-4.071292769506(-3)	5.977910739213(-1)	4.022089260787(-1)
92	5.941649861116(-1)	-4.252402479537(-3)	5.899125836321(-1)	4.100874163679(-1)
93	5.863823888967(-1)	-4.439990367676(-3)	5.819423985290(-1)	4.180576014710(-1)
94	5.785106592443(-1)	-4.634282287134(-3)	5.738763769571(-1)	4.261236230429(-1)
95	5.705454872821(-1)	-4.835516995603(-3)	5.657099702865(-1)	4.342900297135(-1)
96	5.624821313879(-1)	-5.043947396685(-3)	5.574381839912(-1)	4.425618160088(-1)
97	5.543153756091(-1)	-5.259841934541(-3)	5.490555336745(-1)	4.509444663255(-1)
98	5.460394813983(-1)	-5.483486165294(-3)	5.405559952330(-1)	4.594440047670(-1)
99	5.376481327372(-1)	-5.715184533101(-3)	5.319329482041(-1)	4.680675017959(-1)
100	5.291343735392(-1)	-5.955262384130(-3)	5.231791111550(-1)	4.768208888450(-1)
101	5.204905360015(-1)	-6.204068258196(-3)	5.142864677433(-1)	4.857135322567(-1)
102	5.117081583044(-1)	-6.461976505811(-3)	5.052461817985(-1)	4.947538182015(-1)
103	5.027778897169(-1)	-6.729390288342(-3)	4.960484994285(-1)	5.039515005715(-1)
104	4.936893807489(-1)	-7.006745031305(-3)	4.866826357176(-1)	5.133173642824(-1)
105	4.844311554581(-1)	-7.294512416272(-3)	4.771366430418(-1)	5.228633569582(-1)
106	4.749904623527(-1)	-7.593205016365(-3)	4.673972573364(-1)	5.326027426636(-1)
107	4.653530994845(-1)	-7.903381705006(-3)	4.574497177795(-1)	5.425502822205(-1)
108	4.555032082313(-1)	-8.225653999204(-3)	4.472775542321(-1)	5.527224457679(-1)
109	4.454230288711(-1)	-8.560693539346(-3)	4.368623353317(-1)	5.631376646683(-1)
110	4.350926092136(-1)	-8.909240960317(-3)	4.261833682533(-1)	5.738166317467(-1)
111	4.244894551587(-1)	-9.272116478006(-3)	4.152173386807(-1)	5.847826613193(-1)
112	4.135881088653(-1)	-9.650232606856(-3)	4.039378762584(-1)	5.960621237416(-1)
113	4.023596359541(-1)	-1.004460954641(-2)	3.923150264077(-1)	6.076849735923(-1)
114	3.907709974037(-1)	-1.045639394001(-2)	3.803146034636(-1)	6.196853965364(-1)
115	3.787842739037(-1)	-1.088688193437(-2)	3.678973919693(-1)	6.321026080307(-1)
116	3.663556994918(-1)	-1.133754778091(-2)	3.550181517109(-1)	6.449818482891(-1)
117	3.534344459285(-1)	-1.181007965731(-2)	3.416243662712(-1)	6.583756337288(-1)
118	3.399610773441(-1)	-1.230642501025(-2)	3.276546523339(-1)	6.723453476661(-1)
119	3.258655629355(-1)	-1.282884862101(-2)	3.130367143144(-1)	6.869632856856(-1)
120	3.110646886459(-1)	-1.338000792037(-2)	2.976846807255(-1)	7.023153192745(-1)
121	2.954586383298(-1)	-1.396305206833(-2)	2.814955862615(-1)	7.185044137385(-1)
122	2.789264066879(-1)	-1.458175436292(-2)	2.643446523250(-1)	7.356553476750(-1)
123	2.613195359776(-1)	-1.524069233081(-2)	2.460788436468(-1)	7.539211563532(-1)
124	2.424533932801(-1)	-1.594549757623(-2)	2.265078957039(-1)	7.734921042961(-1)
125	2.220947466080(-1)	-1.670321030550(-2)	2.053915363025(-1)	7.946084636975(-1)
126	1.999436076035(-1)	-1.752279554152(-2)	1.824208120620(-1)	8.175791879380(-1)
127	1.756058905806(-1)	-1.841591759808(-2)	1.571899729825(-1)	8.428100270175(-1)
128	1.485507746440(-1)	-1.939814352299(-2)	1.291526311210(-1)	8.708473688790(-1)
129	1.180413763984(-1)	-2.049089290084(-2)	9.755048349757(-2)	9.024495165024(-1)
130	8.301617456742(-2)	-2.172476103579(-2)	6.129141353163(-2)	9.387085864684(-1)
131	4.187306306191(-2)	-2.314554999793(-2)	1.872751306398(-2)	9.812724869360(-1)
132	-7.956742366717(-3)	-2.482612749043(-2)	-3.278286985715(-2)	1.032782869857(0)
133	-7.094382391634(-2)	-2.689236244598(-2)	-9.783618636232(-2)	1.097836186362(0)
134	-1.558434945552(-1)	-2.958898367887(-2)	-1.854324782340(-1)	1.185432478234(0)
135	-2.833345206198(-1)	-3.348992917873(-2)	-3.168244497986(-1)	1.316824449799(0)
136	-5.232969101326(-1)	-4.052078443812(-2)	-5.638176945707(-1)	1.563817694571(0)
137	-1.980378563221(0)	-8.080909352125(-2)	-2.061187656742(0)	3.061187656742(0)

**Table 5**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $2p_{3/2}$  ( $\mu = \pm 3/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	-1.459736107538(-13)	-6.656537471650(-6)	-6.656537617623(-6)	1.00006656538(0)
2	-2.335796642897(-12)	-2.662756786883(-5)	-2.662757020463(-5)	1.000026627570(0)
3	-1.182681755791(-11)	-5.991734591152(-5)	-5.991735773834(-5)	1.000059917358(0)
4	-3.738675872202(-11)	-1.065329653780(-4)	-1.065330027648(-4)	1.000106533003(0)
5	-9.130193600708(-11)	-1.664843629754(-4)	-1.664844542773(-4)	1.000166484454(0)
6	-1.893887806560(-10)	-2.397843237631(-4)	-2.397845131519(-4)	1.000239784513(0)
7	-3.510086778680(-10)	-3.264484881370(-4)	-3.264488391457(-4)	1.000326448839(0)
8	-5.990861407348(-10)	-4.264953603782(-4)	-4.264959594643(-4)	1.000426495959(0)
9	-9.601303423666(-10)	-5.399463187787(-4)	-5.399472789091(-4)	1.000539947279(0)
10	-1.464260033299(-9)	-6.668256273518(-4)	-6.668270916119(-4)	1.000666827092(0)
11	-2.145231875569(-9)	-8.071604491406(-4)	-8.071625943724(-4)	1.000807162594(0)
12	-3.040472229216(-9)	-9.609808611378(-4)	-9.609839016100(-4)	1.000960983902(0)
13	-4.191112431358(-9)	-1.128319870833(-3)	-1.128324061945(-3)	1.001128324062(0)
14	-5.642027612541(-9)	-1.309213434404(-3)	-1.309219076431(-3)	1.001309219076(0)
15	-7.441879099576(-9)	-1.503700476570(-3)	-1.503707918449(-3)	1.001503707918(0)
16	-9.643160458799(-9)	-1.711822912131(-3)	-1.711832555291(-3)	1.001711832555(0)
17	-1.230224723843(-8)	-1.933625669212(-3)	-1.933637971460(-3)	1.001933637971(0)
18	-1.547945047361(-8)	-2.169156714239(-3)	-2.169172193689(-3)	1.002169172194(0)
19	-1.923907402260(-8)	-2.418467078667(-3)	-2.418486317741(-3)	1.002418486318(0)
20	-2.364947580800(-8)	-2.681610887504(-3)	-2.681634536980(-3)	1.002681634537(0)
21	-2.878313304169(-8)	-2.958645389640(-3)	-2.958674172773(-3)	1.002958674173(0)
22	-3.471671151806(-8)	-3.249630990027(-3)	-3.249665706738(-3)	1.003249665707(0)
23	-4.153113906534(-8)	-3.554631283743(-3)	-3.554672814882(-3)	1.003554672815(0)
24	-4.931168325076(-8)	-3.873713091975(-3)	-3.873762403658(-3)	1.003873762404(0)
25	-5.814803344104(-8)	-4.206946499955(-3)	-4.207004647988(-3)	1.004207004648(0)
26	-6.813438732611(-8)	-4.554404896897(-3)	-4.554473031284(-3)	1.004554473031(0)
27	-7.936954201979(-8)	-4.916165017977(-3)	-4.916244387519(-3)	1.004916244388(0)
28	-9.195698985837(-8)	-5.292306988400(-3)	-5.292398945390(-3)	1.005292398945(0)
29	-1.060050190242(-7)	-5.682914369599(-3)	-5.683020374618(-3)	1.005683020375(0)
30	-1.216268191286(-7)	-6.088074207626(-3)	-6.088195834445(-3)	1.006088195834(0)
31	-1.389405918965(-7)	-6.507877083781(-3)	-6.508016024373(-3)	1.006508016024(0)
32	-1.580696671007(-7)	-6.942417167539(-3)	-6.942575237206(-3)	1.006942575237(0)
33	-1.791426239043(-7)	-7.391792271831(-3)	-7.391971414455(-3)	1.007391971414(0)
34	-2.022934177759(-7)	-7.856103910746(-3)	-7.856306204163(-3)	1.007856306204(0)
35	-2.276615131518(-7)	-8.335457359716(-3)	-8.335685021229(-3)	1.008335685021(0)
36	-2.553920220267(-7)	-8.829961718255(-3)	-8.830217110277(-3)	1.008830217110(0)
37	-2.856358486674(-7)	-9.339729975321(-3)	-9.340015611169(-3)	1.009340015611(0)
38	-3.185498406482(-7)	-9.864879077378(-3)	-9.865197627219(-3)	1.009865197627(0)
39	-3.542969464220(-7)	-1.040552999924(-2)	-1.040588429619(-2)	1.010405884296(0)
40	-3.930463796477(-7)	-1.096180781779(-2)	-1.096220086417(-2)	1.010962200864(0)
41	-4.349737905081(-7)	-1.153384178860(-2)	-1.153427676239(-2)	1.011534276762(0)
42	-4.802614442626(-7)	-1.212176542568(-2)	-1.212224568712(-2)	1.012122245687(0)
43	-5.290984072908(-7)	-1.272571658426(-2)	-1.272624568267(-2)	1.012726245683(0)
44	-5.816807408971(-7)	-1.334583754690(-2)	-1.334641922764(-2)	1.013346419228(0)
45	-6.382117031582(-7)	-1.398227511288(-2)	-1.398291332458(-2)	1.013982913325(0)
46	-6.989019591087(-7)	-1.463518069107(-2)	-1.463587959303(-2)	1.014635879593(0)
47	-7.639697995770(-7)	-1.530471039635(-2)	-1.530547436615(-2)	1.015305474366(0)
48	-8.336413689952(-7)	-1.599102514975(-2)	-1.599185879112(-2)	1.015991858791(0)
49	-9.081509025259(-7)	-1.669429078234(-2)	-1.669519893324(-2)	1.016695198933(0)
50	-9.877409728625(-7)	-1.741467814313(-2)	-1.741566588410(-2)	1.017415665884(0)
51	-1.072662747079(-6)	-1.815236321099(-2)	-1.815343587374(-2)	1.018153435874(0)
52	-1.163176253925(-6)	-1.890752721088(-2)	-1.890869038714(-2)	1.018908690387(0)
53	-1.259550661971(-6)	-1.968035673435(-2)	-1.968161628501(-2)	1.019681616285(0)
54	-1.362064569050(-6)	-2.047104386464(-2)	-2.047240592921(-2)	1.020472405929(0)
55	-1.471006303438(-6)	-2.127978630649(-2)	-2.128125731280(-2)	1.021281257313(0)
56	-1.586674237255(-6)	-2.210678752081(-2)	-2.210837419505(-2)	1.022108374195(0)
57	-1.709377112584(-6)	-2.295225686435(-2)	-2.295396624147(-2)	1.022953966241(0)
58	-1.839434380836(-6)	-2.381640973474(-2)	-2.381824916912(-2)	1.023818249169(0)
59	-1.977176555908(-6)	-2.469946772082(-2)	-2.470144489738(-2)	1.024701444897(0)
60	-2.122945581718(-6)	-2.560165875879(-2)	-2.560378170437(-2)	1.025603781704(0)
61	-2.277095214709(-6)	-2.652321729409(-2)	-2.652549438930(-2)	1.026525494389(0)
62	-2.439991421977(-6)	-2.746438444947(-2)	-2.746682444090(-2)	1.027466824441(0)
63	-2.612012795683(-6)	-2.842540819940(-2)	-2.842802021220(-2)	1.028428020212(0)
64	-2.793550984443(-6)	-2.940654355100(-2)	-2.940933710199(-2)	1.029409337102(0)
65	-2.985011142455(-6)	-3.040805273194(-2)	-3.041103774308(-2)	1.030411037743(0)
66	-3.186812397116(-6)	-3.143020538538(-2)	-3.143339219778(-2)	1.031433392198(0)
67	-3.399388335954(-6)	-3.247327877244(-2)	-3.247667816077(-2)	1.032476678161(0)
68	-3.623187513741(-6)	-3.353755798228(-2)	-3.354118116979(-2)	1.033541181170(0)
69	-3.858673980662(-6)	-3.462333615035(-2)	-3.462719482433(-2)	1.034627194824(0)
70	-4.106327832518(-6)	-3.573091468499(-2)	-3.573502101282(-2)	1.035735021013(0)
71	-4.366645783930(-6)	-3.686060350273(-2)	-3.686497014851(-2)	1.036864970149(0)
72	-4.640141765615(-6)	-3.801272127278(-2)	-3.801736141454(-2)	1.038017361415(0)
73	-4.927347546823(-6)	-3.918759567099(-2)	-3.919252301854(-2)	1.039192523019(0)
74	-5.228813384107(-6)	-4.038556364373(-2)	-4.039079245712(-2)	1.040390792457(0)

(continued on next page)

Table 5 (continued)

Z	$\chi_p'/X$	$\chi_p''/X$	$\chi_p/X$	$\chi_a/X$
75	-5.545108697629(-6)	-4.160697168212(-2)	-4.161251679081(-2)	1.041612516791(0)
76	-5.876822776323(-6)	-4.285217610703(-2)	-4.285805292980(-2)	1.042858052930(0)
77	-6.224565513233(-6)	-4.412154336543(-2)	-4.412776793094(-2)	1.044127767931(0)
78	-6.588968172484(-6)	-4.541545033845(-2)	-4.542203930662(-2)	1.045422039307(0)
79	-6.970684189386(-6)	-4.673428466177(-2)	-4.674125534596(-2)	1.046741255346(0)
80	-7.370390005251(-6)	-4.807844505885(-2)	-4.808581544885(-2)	1.048085815449(0)
81	-7.788785938608(-6)	-4.944834168766(-2)	-4.945613047360(-2)	1.049456130474(0)
82	-8.226597094583(-6)	-5.084439650141(-2)	-5.085262309850(-2)	1.050852623099(0)
83	-8.684574314308(-6)	-5.226704362401(-2)	-5.227572819833(-2)	1.052275728198(0)
84	-9.163495166332(-6)	-5.371672974095(-2)	-5.372589323611(-2)	1.053725893236(0)
85	-9.664164982110(-6)	-5.519391450622(-2)	-5.520357867120(-2)	1.055203578671(0)
86	-1.018741793777(-5)	-5.669907096623(-2)	-5.670925838417(-2)	1.056709258384(0)
87	-1.073411818449(-5)	-5.823268600126(-2)	-5.824342011944(-2)	1.058243420119(0)
88	-1.130516102991(-5)	-5.979526078554(-2)	-5.980656594657(-2)	1.059806565947(0)
89	-1.190147417324(-5)	-6.138731126673(-2)	-6.139921274090(-2)	1.061399212741(0)
90	-1.252401899669(-5)	-6.300936866567(-2)	-6.302189268466(-2)	1.063021892685(0)
91	-1.317379191629(-5)	-6.466197999764(-2)	-6.467515378956(-2)	1.064675153790(0)
92	-1.385182579506(-5)	-6.634570861593(-2)	-6.635956044172(-2)	1.066359560442(0)
93	-1.455919142176(-5)	-6.806113477890(-2)	-6.807569397032(-2)	1.068075693970(0)
94	-1.529699905882(-5)	-6.980885624190(-2)	-6.982415324096(-2)	1.069824153241(0)
95	-1.606640006298(-5)	-7.158948887497(-2)	-7.160555527503(-2)	1.071605555275(0)
96	-1.686858858251(-5)	-7.340366730792(-2)	-7.342053589650(-2)	1.073420535897(0)
97	-1.770480333522(-5)	-7.525204560406(-2)	-7.526975040739(-2)	1.075269750407(0)
98	-1.857632947155(-5)	-7.713529796403(-2)	-7.715387429350(-2)	1.077153874294(0)
99	-1.948450052738(-5)	-7.905411946145(-2)	-7.907360396198(-2)	1.079073603962(0)
100	-2.043070047145(-5)	-8.100922681185(-2)	-8.102965751232(-2)	1.081029657512(0)
101	-2.141636585273(-5)	-8.300135917683(-2)	-8.302277554269(-2)	1.083022775543(0)
102	-2.244298805308(-5)	-8.503127900520(-2)	-8.505372199326(-2)	1.085053721993(0)
103	-2.351211565134(-5)	-8.709977291316(-2)	-8.712328502881(-2)	1.087123285029(0)
104	-2.462535690494(-5)	-8.920765260556(-2)	-8.923227796246(-2)	1.089232277962(0)
105	-2.578438235577(-5)	-9.135575584061(-2)	-9.138154022297(-2)	1.091381540223(0)
106	-2.699092756746(-5)	-9.354494744029(-2)	-9.357193836786(-2)	1.093571938368(0)
107	-2.824679600157(-5)	-9.577612034904(-2)	-9.580436714504(-2)	1.095804367145(0)
108	-2.955386204083(-5)	-9.805019674347(-2)	-9.807975060551(-2)	1.098079750606(0)
109	-3.091407416794(-5)	-1.003681291960(-1)	-1.003990432702(-1)	1.100399043270(0)
110	-3.232945830916(-5)	-1.027309018953(-1)	-1.027632313536(-1)	1.102763231354(0)
111	-3.380212135251(-5)	-1.051395319269(-1)	-1.051733340483(-1)	1.105173334048(0)
112	-3.533425485096(-5)	-1.075950706180(-1)	-1.076304048729(-1)	1.107630404873(0)
113	-3.692813892172(-5)	-1.100986049487(-1)	-1.101355330876(-1)	1.110135533088(0)
114	-3.858614635381(-5)	-1.126512590353(-1)	-1.126898451817(-1)	1.112689845182(0)
115	-4.031074693626(-5)	-1.152541956894(-1)	-1.152945064363(-1)	1.115294506436(0)
116	-4.210451202099(-5)	-1.179086180559(-1)	-1.179507225679(-1)	1.117950722568(0)
117	-4.397011933471(-5)	-1.206157713376(-1)	-1.206597414569(-1)	1.120659741457(0)
118	-4.591035805549(-5)	-1.233769446084(-1)	-1.234228549664(-1)	1.123422854966(0)
119	-4.792813417096(-5)	-1.261934727230(-1)	-1.262414008572(-1)	1.126241400857(0)
120	-5.002647613584(-5)	-1.290667383281(-1)	-1.291167648042(-1)	1.129116764804(0)
121	-5.220854084827(-5)	-1.319981739810(-1)	-1.320503825218(-1)	1.132050382522(0)
122	-5.447761996551(-5)	-1.349892643834(-1)	-1.350437420033(-1)	1.135043742003(0)
123	-5.683714658129(-5)	-1.380415487372(-1)	-1.380983858837(-1)	1.138098385884(0)
124	-5.929070228871(-5)	-1.411566232298(-1)	-1.412159139321(-1)	1.141215913932(0)
125	-6.184202465425(-5)	-1.443361436582(-1)	-1.443979856829(-1)	1.144397985683(0)
126	-6.449501513066(-5)	-1.475818281999(-1)	-1.476463232150(-1)	1.147646323215(0)
127	-6.725374743841(-5)	-1.508954603408(-1)	-1.509627140883(-1)	1.150962714088(0)
128	-7.012247644777(-5)	-1.542788919719(-1)	-1.543490144484(-1)	1.154349014448(0)
129	-7.310564759605(-5)	-1.577340466629(-1)	-1.578071523105(-1)	1.157807152311(0)
130	-7.620790687734(-5)	-1.612629231283(-1)	-1.613391310351(-1)	1.161339131035(0)
131	-7.943411144501(-5)	-1.648675988967(-1)	-1.649470330082(-1)	1.164947033008(0)
132	-8.278934087035(-5)	-1.685502341995(-1)	-1.686330235404(-1)	1.168633023540(0)
133	-8.627890910453(-5)	-1.723130760915(-1)	-1.723993550006(-1)	1.172399355001(0)
134	-8.990837719467(-5)	-1.761584628233(-1)	-1.762483712005(-1)	1.176248371200(0)
135	-9.368356680911(-5)	-1.800888284805(-1)	-1.801825120473(-1)	1.180182512047(0)
136	-9.761057463165(-5)	-1.841067079109(-1)	-1.842043184855(-1)	1.184204318486(0)
137	-1.016957876894(-4)	-1.882147419599(-1)	-1.883164377476(-1)	1.188316437747(0)

**Table 6**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3s_{1/2}$ , obtained with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	-1.429350016908(-9)	-1.929449188815(-7)	-1.943742688984(-7)	1.000000194374(0)
2	-5.719405736176(-9)	-7.718424266792(-7)	-7.775618324154(-7)	1.00000077562(0)
3	-1.287618535032(-8)	-1.736880837419(-6)	-1.749757022770(-6)	1.000001749757(0)
4	-2.290972313821(-8)	-3.088374209821(-6)	-3.111283932959(-6)	1.000003111284(0)
5	-3.583407540823(-8)	-4.826762650738(-6)	-4.862596726147(-6)	1.000004862597(0)
6	-5.166732883074(-8)	-6.952612740844(-6)	-7.004280069674(-6)	1.000007004280(0)
7	-7.043161117231(-8)	-9.466618083406(-6)	-9.537049694578(-6)	1.000009537050(0)
8	-9.215310444725(-8)	-1.236959997729(-5)	-1.246175308174(-5)	1.000012461753(0)
9	-1.168620605059(-7)	-1.566250821556(-5)	-1.577937027607(-5)	1.000015779370(0)
10	-1.445928190829(-7)	-1.934642201127(-5)	-1.949101483035(-5)	1.000019491015(0)
11	-1.753838283314(-7)	-2.342255105240(-5)	-2.359793488074(-5)	1.000023597935(0)
12	-2.092776678752(-7)	-2.789223668813(-5)	-2.810151435600(-5)	1.000028101514(0)
13	-2.463210744112(-7)	-3.275695324875(-5)	-3.300327432316(-5)	1.000033003274(0)
14	-2.865649699029(-7)	-3.801830950219(-5)	-3.830487447210(-5)	1.000038304874(0)
15	-3.300644924050(-7)	-4.367805025003(-5)	-4.400811474244(-5)	1.000044008115(0)
16	-3.768790295682(-7)	-4.973805806639(-5)	-5.011493709595(-5)	1.000050114937(0)
17	-4.270722548731(-7)	-5.620035518340(-5)	-5.662742743828(-5)	1.000056627427(0)
18	-4.807121666507(-7)	-6.306710552734(-5)	-6.354781769399(-5)	1.000063547818(0)
19	-5.378711299482(-7)	-7.034061690962(-5)	-7.087848803957(-5)	1.000070878488(0)
20	-5.986259213066(-7)	-7.802334337753(-5)	-7.862196929884(-5)	1.000078621969(0)
21	-6.630577765199(-7)	-8.611788772981(-5)	-8.678094550633(-5)	1.000086780946(0)
22	-7.312524414502(-7)	-9.462700420254(-5)	-9.535825664399(-5)	1.000095358257(0)
23	-8.033002259824(-7)	-1.035536013314(-4)	-1.043569015574(-4)	1.000104356902(0)
24	-8.792960612029(-7)	-1.129007449966(-4)	-1.137800410578(-4)	1.000113780041(0)
25	-9.593395598969(-7)	-1.226716616574(-4)	-1.236310012173(-4)	1.000123631001(0)
26	-1.043535080462(-6)	-1.328697417839(-4)	-1.339132768644(-4)	1.000133913277(0)
27	-1.131991794348(-6)	-1.434985434931(-4)	-1.446305352875(-4)	1.000144630535(0)
28	-1.224823757129(-6)	-1.545617963994(-4)	-1.557866201566(-4)	1.000155786620(0)
29	-1.322149983335(-6)	-1.660634056867(-4)	-1.673855556700(-4)	1.000167385556(0)
30	-1.424094525172(-6)	-1.780074564130(-4)	-1.794315509382(-4)	1.000179431551(0)
31	-1.530786555258(-6)	-1.903982180585(-4)	-1.919290046138(-4)	1.000191929005(0)
32	-1.642360453534(-6)	-2.032401493262(-4)	-2.048825097797(-4)	1.000204882510(0)
33	-1.758955898493(-6)	-2.165379032092(-4)	-2.182968591077(-4)	1.000218296859(0)
34	-1.880717962900(-6)	-2.302963323368(-4)	-2.321770502997(-4)	1.000232177050(0)
35	-2.007797214174(-6)	-2.445204946115(-4)	-2.465282918257(-4)	1.000246528292(0)
36	-2.140349819622(-6)	-2.592156591546(-4)	-2.613560089743(-4)	1.000261356009(0)
37	-2.278537656718(-6)	-2.743873125728(-4)	-2.766658502295(-4)	1.000276665850(0)
38	-2.422528428644(-6)	-2.900411655648(-4)	-2.924636939934(-4)	1.000292463694(0)
39	-2.572495785320(-6)	-3.061831598846(-4)	-3.087556556699(-4)	1.000308755656(0)
40	-2.728619450149(-6)	-3.228194756819(-4)	-3.255480951320(-4)	1.000325548095(0)
41	-2.891085352745(-6)	-3.399565392381(-4)	-3.428476245908(-4)	1.000342847625(0)
42	-3.060085767918(-6)	-3.576010311225(-4)	-3.606611168904(-4)	1.000360661117(0)
43	-3.235819461184(-6)	-3.757598947901(-4)	-3.789957142513(-4)	1.000378995714(0)
44	-3.418491841132(-6)	-3.944403456481(-4)	-3.978588374892(-4)	1.000397858837(0)
45	-3.608315118964(-6)	-4.136498806165(-4)	-4.172581957354(-4)	1.000417258196(0)
46	-3.805508475558(-6)	-4.333962882137(-4)	-4.372017966893(-4)	1.000437201797(0)
47	-4.010298236436(-6)	-4.536876591978(-4)	-4.576979574343(-4)	1.000457697957(0)
48	-4.222918055020(-6)	-4.745323977966(-4)	-4.787553158516(-4)	1.000478755316(0)
49	-4.443609104622(-6)	-4.959392335638(-4)	-5.003828426684(-4)	1.000500382843(0)
50	-4.672620279609(-6)	-5.179172338997(-4)	-5.225898541793(-4)	1.000522589854(0)
51	-4.910208406237(-6)	-5.404758172791(-4)	-5.453860256853(-4)	1.000545386026(0)
52	-5.156638463672(-6)	-5.636247672302(-4)	-5.687814056938(-4)	1.000568781406(0)
53	-5.412183815759(-6)	-5.873742471157(-4)	-5.927864309315(-4)	1.000592786431(0)
54	-5.677126454141(-6)	-6.117348157675(-4)	-6.174119422217(-4)	1.000617411942(0)
55	-5.951757253357(-6)	-6.367174440314(-4)	-6.426692012848(-4)	1.000642669201(0)
56	-6.236376238624(-6)	-6.623335322856(-4)	-6.685699085242(-4)	1.000668569909(0)
57	-6.531292867035(-6)	-6.885949289976(-4)	-6.951262218646(-4)	1.000695126222(0)
58	-6.836826322971(-6)	-7.155139503931(-4)	-7.223507767161(-4)	1.000722350777(0)
59	-7.153305828579(-6)	-7.431034013154(-4)	-7.502567071439(-4)	1.000750256707(0)
60	-7.481070970245(-6)	-7.713765973587(-4)	-7.788576683290(-4)	1.000778857668(0)
61	-7.820472042051(-6)	-8.003473883707(-4)	-8.081678604128(-4)	1.000808167860(0)
62	-8.171870407294(-6)	-8.300301834214(-4)	-8.382020538287(-4)	1.000838202054(0)
63	-8.535638879218(-6)	-8.604399773508(-4)	-8.689756162300(-4)	1.000868975616(0)
64	-8.912162122219(-6)	-8.915923790124(-4)	-9.005045411346(-4)	1.000900504541(0)
65	-9.301837074872(-6)	-9.235036413435(-4)	-9.328054784184(-4)	1.000932805478(0)
66	-9.705073396256(-6)	-9.561906934041(-4)	-9.658957668004(-4)	1.000965895767(0)
67	-1.012229393716(-5)	-9.896711745394(-4)	-9.997934684766(-4)	1.000999793468(0)
68	-1.055393523792(-5)	-1.023963470836(-3)	-1.034517406074(-3)	1.001034517406(0)
69	-1.100044805471(-5)	-1.059086754057(-3)	-1.070087202112(-3)	1.001070087202(0)
70	-1.146229791645(-5)	-1.095061023263(-3)	-1.106523321179(-3)	1.001106523321(0)
71	-1.193996571441(-5)	-1.131907149338(-3)	-1.143847115052(-3)	1.001143847115(0)
72	-1.243394832709(-5)	-1.169646922675(-3)	-1.182080871002(-3)	1.001182080871(0)
73	-1.294475928289(-5)	-1.208303104285(-3)	-1.221247863568(-3)	1.001221247864(0)
74	-1.347292946364(-5)	-1.247899480632(-3)	-1.261372410095(-3)	1.001261372410(0)

(continued on next page)



Table 6 (continued)

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_a/\chi$
75	-1.401900785207(-5)	-1.288460922531(-3)	-1.302479930383(-3)	1.001302479930(0)
76	-1.458356232667(-5)	-1.330013448470(-3)	-1.344597010797(-3)	1.001344597011(0)
77	-1.516718050801(-5)	-1.372584292759(-3)	-1.387751473267(-3)	1.001387751473(0)
78	-1.577047066049(-5)	-1.416201978967(-3)	-1.431972449627(-3)	1.001431972450(0)
79	-1.639406265434(-5)	-1.460896399140(-3)	-1.477290461795(-3)	1.001477290462(0)
80	-1.703860899303(-5)	-1.506698899367(-3)	-1.523737508360(-3)	1.001523737508(0)
81	-1.770478591169(-5)	-1.553642372301(-3)	-1.571347158213(-3)	1.001571347158(0)
82	-1.839329455300(-5)	-1.601761357358(-3)	-1.620154651911(-3)	1.001620154652(0)
83	-1.910486222750(-5)	-1.651092149344(-3)	-1.670197011572(-3)	1.001670197012(0)
84	-1.984024376606(-5)	-1.701672916412(-3)	-1.721513160178(-3)	1.001721513160(0)
85	-2.060022297342(-5)	-1.753543828312(-3)	-1.774144051286(-3)	1.001774144051(0)
86	-2.138561419232(-5)	-1.806747196058(-3)	-1.828132810251(-3)	1.001828132810(0)
87	-2.219726398924(-5)	-1.861327624259(-3)	-1.883524888248(-3)	1.001883524888(0)
88	-2.303605297399(-5)	-1.917332177526(-3)	-1.940368230500(-3)	1.001940368230(0)
89	-2.390289776676(-5)	-1.974810562571(-3)	-1.998713460338(-3)	1.001998713460(0)
90	-2.479875312832(-5)	-2.033815327828(-3)	-2.058614080956(-3)	1.002058614081(0)
91	-2.572461427080(-5)	-2.094402082662(-3)	-2.120126696933(-3)	1.002120126697(0)
92	-2.668151936886(-5)	-2.156629738581(-3)	-2.183311257950(-3)	1.002183311258(0)
93	-2.767055229397(-5)	-2.220560775153(-3)	-2.248231327447(-3)	1.002248231327(0)
94	-2.869284559738(-5)	-2.286261533783(-3)	-2.314954379381(-3)	1.002314954379(0)
95	-2.974958377131(-5)	-2.353802542978(-3)	-2.383552126749(-3)	1.002383552127(0)
96	-3.084200682198(-5)	-2.423258879272(-3)	-2.454100886094(-3)	1.002454100886(0)
97	-3.197141419334(-5)	-2.494710568690(-3)	-2.526681982884(-3)	1.002526681983(0)
98	-3.313916908629(-5)	-2.568243034411(-3)	-2.601382203497(-3)	1.002601382203(0)
99	-3.434670322525(-5)	-2.643947597236(-3)	-2.678294300461(-3)	1.002678294300(0)
100	-3.559552213241(-5)	-2.721922036650(-3)	-2.757517558782(-3)	1.002757517559(0)
101	-3.688721098020(-5)	-2.802271221601(-3)	-2.839158432581(-3)	1.002839158433(0)
102	-3.822344110449(-5)	-2.885107821841(-3)	-2.923331262946(-3)	1.002923331263(0)
103	-3.960597727578(-5)	-2.970553112666(-3)	-3.010159089942(-3)	1.003010159090(0)
104	-4.103668584359(-5)	-3.058737888408(-3)	-3.099774574252(-3)	1.003099774574(0)
105	-4.251754389068(-5)	-3.149803503095(-3)	-3.192321046986(-3)	1.003192321047(0)
106	-4.405064956076(-5)	-3.243903060462(-3)	-3.287953710023(-3)	1.003287953710(0)
107	-4.563823375597(-5)	-3.341202780233(-3)	-3.386841013989(-3)	1.003386841014(0)
108	-4.728267344167(-5)	-3.441883573492(-3)	-3.489166246934(-3)	1.003489166247(0)
109	-4.898650684731(-5)	-3.546142867417(-3)	-3.595129374264(-3)	1.003595129374(0)
110	-5.075245091664(-5)	-3.654196729128(-3)	-3.704949180045(-3)	1.003704949180(0)
111	-5.258342144330(-5)	-3.766282350542(-3)	-3.818865771985(-3)	1.003818865772(0)
112	-5.448255643285(-5)	-3.882660971816(-3)	-3.937143528249(-3)	1.003937143528(0)
113	-5.645324336915(-5)	-4.003621341424(-3)	-4.060074584793(-3)	1.004060074585(0)
114	-5.849915124130(-5)	-4.129483837838(-3)	-4.187982989079(-3)	1.004187982989(0)
115	-6.062426842289(-5)	-4.260605413649(-3)	-4.321229682072(-3)	1.004321229682(0)
116	-6.283294780993(-5)	-4.397385571195(-3)	-4.460218519005(-3)	1.004460218519(0)
117	-6.512996104884(-5)	-4.540273644492(-3)	-4.605403605540(-3)	1.004605403606(0)
118	-6.752056426897(-5)	-4.689777753046(-3)	-4.757298317315(-3)	1.004757298317(0)
119	-7.001057854366(-5)	-4.846475920293(-3)	-4.916486498837(-3)	1.004916486499(0)
120	-7.260648944829(-5)	-5.011030030491(-3)	-5.083636519940(-3)	1.005083636520(0)
121	-7.531557172932(-5)	-5.184203560319(-3)	-5.259519132049(-3)	1.005259519132(0)
122	-7.814604750967(-5)	-5.366884409192(-3)	-5.445030456702(-3)	1.005445030457(0)
123	-8.110729007068(-5)	-5.560114737924(-3)	-5.641222027995(-3)	1.005641222028(0)
124	-8.421009079852(-5)	-5.765130631579(-3)	-5.849340722378(-3)	1.005849340722(0)
125	-8.746701563855(-5)	-5.983415843772(-3)	-6.070882859411(-3)	1.006070882859(0)
126	-9.089289165517(-5)	-6.216776245247(-3)	-6.307669136902(-3)	1.006307669137(0)
127	-9.450548835121(-5)	-6.467445624033(-3)	-6.561951112384(-3)	1.006561951112(0)
128	-9.832650073085(-5)	-6.738240623307(-3)	-6.836567124038(-3)	1.006836567124(0)
129	-1.023830193286(-4)	-7.032795905317(-3)	-7.135178924645(-3)	1.007135178925(0)
130	-1.067098258052(-4)	-7.355936921351(-3)	-7.462646747156(-3)	1.007462646747(0)
131	-1.113531758160(-4)	-7.714303512479(-3)	-7.825656688295(-3)	1.007825656688(0)
132	-1.163774757509(-4)	-8.117467393942(-3)	-8.233844869693(-3)	1.008233844870(0)
133	-1.218781907415(-4)	-8.580125978219(-3)	-8.702004168961(-3)	1.008702004168(0)
134	-1.280101951356(-4)	-9.126996621297(-3)	-9.255006816432(-3)	1.009255006816(0)
135	-1.350634311007(-4)	-9.806090102056(-3)	-9.941153533156(-3)	1.009941153533(0)
136	-1.437496559230(-4)	-1.073989663373(-2)	-1.088364628965(-2)	1.010883646289(0)
137	-1.590304502902(-4)	-1.282647438883(-2)	-1.298550483912(-2)	1.012985504839(0)



**Table 7**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3p_{1/2}$ , obtained with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	1.000133147008(0)	9.847824567274(-12)	1.000133147018(0)	-1.331470179971(-4)
2	1.000532811623(0)	1.576430253022(-10)	1.000532811781(0)	-5.328117809590(-4)
3	1.001199665583(0)	7.987253029434(-10)	1.001199666382(0)	-1.199666381692(-3)
4	1.002134831675(0)	2.527280742689(-9)	1.002134834202(0)	-2.134834202355(-3)
5	1.003339888604(0)	6.179288735281(-9)	1.003339894783(0)	-3.339894783198(-3)
6	1.004816877858(0)	1.283668198739(-8)	1.004816890694(0)	-4.816890694203(-3)
7	1.006568312633(0)	2.383275448470(-8)	1.006568336466(0)	-6.568336465904(-3)
8	1.008597188894(0)	4.075886301895(-8)	1.008597229653(0)	-8.597229652998(-3)
9	1.010906998650(0)	6.547247924897(-8)	1.010907064123(0)	-1.090706412271(-2)
10	1.013501745573(0)	1.001066613954(-7)	1.013501845679(0)	-1.350184567939(-2)
11	1.016385963077(0)	1.470810277442(-7)	1.016386110158(0)	-1.638611015798(-2)
12	1.019564735027(0)	2.091143283492(-7)	1.019564944142(0)	-1.956494414175(-2)
13	1.023043719246(0)	2.892387268969(-7)	1.023044008485(0)	-2.304400848507(-2)
14	1.026829174033(0)	3.908159218728(-7)	1.026829564849(0)	-2.682956484926(-2)
15	1.030927987935(0)	5.17552552286(-7)	1.030928505491(0)	-3.092850549066(-2)
16	1.035347713040(0)	6.735339780113(-7)	1.035348386574(0)	-3.534838657400(-2)
17	1.040096602103(0)	8.632198662543(-7)	1.040097465323(0)	-4.009746532265(-2)
18	1.045183649864(0)	1.091496407271(-6)	1.045184741360(0)	-4.518474136043(-2)
19	1.050618638958(0)	1.363690806824(-6)	1.050620002649(0)	-5.062000264858(-2)
20	1.056412190872(0)	1.685605102081(-6)	1.056413876477(0)	-5.641387647677(-2)
21	1.062575822479(0)	2.063550704426(-6)	1.062577886030(0)	-6.257788602994(-2)
22	1.069122008738(0)	2.504386740979(-6)	1.069124513125(0)	-6.912451312490(-2)
23	1.076064252230(0)	3.015562614907(-6)	1.076067267793(0)	-7.606726779285(-2)
24	1.083417160313(0)	3.605165263531(-6)	1.083420765479(0)	-8.342076547871(-2)
25	1.091196530765(0)	4.281971661077(-6)	1.091200812737(0)	-9.120081273699(-2)
26	1.099419446923(0)	5.055507191320(-6)	1.099424502430(0)	-9.942450243020(-2)
27	1.108104383471(0)	5.936110606236(-6)	1.108110319581(0)	-1.081103195814(-1)
28	1.117271324196(0)	6.935006392318(-6)	1.117278259202(0)	-1.172782592021(-1)
29	1.126941893229(0)	8.064385489222(-6)	1.126949957614(0)	-1.269499576144(-1)
30	1.137139501521(0)	9.337495449157(-6)	1.137148839017(0)	-1.371488390169(-1)
31	1.147889510573(0)	1.076874129388(-5)	1.147900279314(0)	-1.479002793139(-1)
32	1.159219415748(0)	1.237379852422(-5)	1.159231789547(0)	-1.592317895467(-1)
33	1.171159051899(0)	1.416973997060(-5)	1.171173221639(0)	-1.711732216389(-1)
34	1.183740824433(0)	1.617517844923(-5)	1.183756999612(0)	-1.837569996117(-1)
35	1.196999969525(0)	1.841042751647(-5)	1.197018379953(0)	-1.970183799529(-1)
36	1.210974847763(0)	2.089768300439(-5)	1.210995745446(0)	-2.109957454457(-1)
37	1.225707276289(0)	2.366122848692(-5)	1.225730937517(0)	-2.257309375171(-1)
38	1.241242905392(0)	2.672766838569(-5)	1.241269633060(0)	-2.412696330602(-1)
39	1.257631646572(0)	3.012619309817(-5)	1.257661772765(0)	-2.576617727650(-1)
40	1.274928160421(0)	3.38888134491(-5)	1.274962049303(0)	-2.749620493026(-1)
41	1.293192414242(0)	3.805104592099(-5)	1.293230465287(0)	-2.932304652875(-1)
42	1.312490321249(0)	4.265163024089(-5)	1.312532972879(0)	-3.125329728794(-1)
43	1.332894475584(0)	4.773366454054(-5)	1.332942209249(0)	-3.329422092488(-1)
44	1.354485000248(0)	5.334479241415(-5)	1.354538345040(0)	-3.545383450403(-1)
45	1.377350528683(0)	5.953788060481(-5)	1.377410066564(0)	-3.774100665639(-1)
46	1.401589345185(0)	6.637172775341(-5)	1.401655716912(0)	-4.016557169124(-1)
47	1.427310714892(0)	7.391189128941(-5)	1.427384626784(0)	-4.273846267836(-1)
48	1.454636441139(0)	8.223165601759(-5)	1.454718672795(0)	-4.547186727947(-1)
49	1.483702696765(0)	9.141317347813(-5)	1.483794109938(0)	-4.837941099384(-1)
50	1.514662187285(0)	1.015488081815(-4)	1.514763736093(0)	-5.147637360933(-1)
51	1.547686718189(0)	1.127427358108(-4)	1.547799460925(0)	-5.477994609247(-1)
52	1.582970257253(0)	1.251128500768(-4)	1.583095370103(0)	-5.830953701027(-1)
53	1.620732606861(0)	1.387930499643(-4)	1.620871399911(0)	-6.208713999106(-1)
54	1.661223832925(0)	1.539359988165(-4)	1.661377768924(0)	-6.613777689241(-1)
55	1.704729638688(0)	1.707164727153(-4)	1.704900355160(0)	-7.049003551604(-1)
56	1.751577927209(0)	1.893354502600(-4)	1.751767262659(0)	-7.517672626592(-1)
57	1.802146871017(0)	2.100251424228(-4)	1.802356896159(0)	-8.023568961593(-1)
58	1.856874908770(0)	2.330552244207(-4)	1.857107963994(0)	-8.571079639944(-1)
59	1.916273228017(0)	2.587406184045(-4)	1.916531968635(0)	-9.165319686350(-1)
60	1.980941486531(0)	2.874512964252(-4)	1.981228937827(0)	-9.812289378271(-1)
61	2.051587796765(0)	3.196247428824(-4)	2.051907421508(0)	-1.051907421508(-1)
62	2.129054385933(0)	3.557819577149(-4)	2.129410167891(0)	-1.129410167891(-1)
63	2.214350905670(0)	3.965482318848(-4)	2.214747453902(0)	-1.214747453902(-1)
64	2.308698190891(0)	4.426804418369(-4)	2.309140871332(0)	-1.309140871332(-1)
65	2.413586503009(0)	4.951033805074(-4)	2.414081606390(0)	-1.414081606390(-1)
66	2.530854177614(0)	5.549588184566(-4)	2.531409136433(0)	-1.531409136433(-1)
67	2.662795533464(0)	6.236728210148(-4)	2.663419206285(0)	-1.663419206285(-1)
68	2.812311583884(0)	7.030497698413(-4)	2.813014633654(0)	-1.813014633654(-1)
69	2.983124760068(0)	7.954063217420(-4)	2.983920166389(0)	-1.983920166389(-1)
70	3.180091782061(0)	9.037666024309(-4)	3.180995548664(0)	-2.180995548664(-1)
71	3.409671332988(0)	1.032153983302(-3)	3.410703486972(0)	-2.410703486972(-1)
72	3.680643927712(0)	1.186040204745(-3)	3.681829967916(0)	-2.681829967916(-1)
73	4.005258306909(0)	1.373060613215(-3)	4.006631367522(0)	-3.006631367522(-1)
74	4.401131500737(0)	1.604199621333(-3)	4.402735700359(0)	-3.402735700359(-1)

(continued on next page)

Table 7 (continued)

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_a/\chi$
75	4.894551758568(0)	1.895851432736(-3)	4.896447610001(0)	-3.896447610001(0)
76	5.526562311605(0)	2.273615762295(-3)	5.528835927367(0)	-4.528835927367(0)
77	6.365003292059(0)	2.779810923526(-3)	6.367783102983(0)	-5.367783102983(0)
78	7.530647419671(0)	3.489780192220(-3)	7.534137199863(0)	-6.534137199863(0)
79	9.261337538834(0)	4.551907997779(-3)	9.265889446831(0)	-8.265889446831(0)
80	1.209920969349(1)	6.304430716637(-3)	1.210551412420(1)	-1.110551412420(1)
81	1.760617665400(1)	9.721835754284(-3)	1.761589848975(1)	-1.661589848975(1)
82	3.289028999084(1)	1.923891532091(-2)	3.290952890616(1)	-3.190952890616(1)
83	2.898450604463(2)	1.795369150753(-1)	2.900245973614(2)	-2.890245973614(2)
84	-4.152394463689(1)	-2.722806286723(-2)	-4.155117269975(1)	4.255117269975(1)
85	-1.915199734972(1)	-1.329008661386(-2)	-1.916528743634(1)	2.016528743634(1)
86	-1.235090741805(1)	-9.067416099186(-3)	-1.235997483415(1)	1.335997483415(1)
87	-9.061144349677(0)	-7.035972137870(-3)	-9.068180321815(0)	1.006818032182(1)
88	-7.121192729985(0)	-5.847171310916(-3)	-7.127039901296(0)	8.127039901296(0)
89	-5.841578338239(0)	-5.070855720959(-3)	-5.846649193960(0)	6.846649193960(0)
90	-4.934061195408(0)	-4.527203211559(-3)	-4.938588398620(0)	5.938588398620(0)
91	-4.256835493988(0)	-4.127754469965(-3)	-4.260963248458(0)	5.260963248458(0)
92	-3.732017568645(0)	-3.823932793390(-3)	-3.735841501439(0)	4.735841501439(0)
93	-3.313275295163(0)	-3.586847723032(-3)	-3.316862142887(0)	4.316862142887(0)
94	-2.971319563758(0)	-3.398243054525(-3)	-2.974717806813(0)	3.974717806813(0)
95	-2.686727285246(0)	-3.246019089135(-3)	-2.689973304335(0)	3.689973304335(0)
96	-2.446109392762(0)	-3.121841876026(-3)	-2.449231234638(0)	3.449231234638(0)
97	-2.239936091785(0)	-3.019786439832(-3)	-2.242955878224(0)	3.242955878224(0)
98	-2.061239397720(0)	-2.935527367204(-3)	-2.064174925087(0)	3.064174925087(0)
99	-1.904806087965(0)	-2.865835378490(-3)	-1.907671923343(0)	2.907671923343(0)
100	-1.766657617806(0)	-2.808252950347(-3)	-1.769465870756(0)	2.769465870756(0)
101	-1.643704611618(0)	-2.760878870152(-3)	-1.646465490488(0)	2.646465490488(0)
102	-1.533511179186(0)	-2.722221325414(-3)	-1.536233400511(0)	2.536233400511(0)
103	-1.434130371491(0)	-2.691095393696(-3)	-1.436821466885(0)	2.436821466885(0)
104	-1.343986916634(0)	-2.666550049194(-3)	-1.346653466683(0)	2.346653466683(0)
105	-1.261792102323(0)	-2.647815246677(-3)	-1.264439917570(0)	2.264439917570(0)
106	-1.186480963787(0)	-2.634262945951(-3)	-1.189115226732(0)	2.189115226732(0)
107	-1.117165233001(0)	-2.625377997748(-3)	-1.119790610999(0)	2.119790610999(0)
108	-1.053097609082(0)	-2.620736125284(-3)	-1.055718345208(0)	2.055718345208(0)
109	-9.936442815525(-1)	-2.619987092665(-3)	-9.962642686452(-1)	1.996264268645(0)
110	-9.382635503441(-1)	-2.622841721480(-3)	-9.408863920655(-1)	1.940886392066(0)
111	-8.864890037166(-1)	-2.629061803564(-3)	-8.891180655201(-1)	1.889118065520(0)
112	-8.379161396849(-1)	-2.638452224477(-3)	-8.405545919093(-1)	1.840554591909(0)
113	-7.921916125626(-1)	-2.650854799221(-3)	-7.948424673618(-1)	1.794842467362(0)
114	-7.490044951745(-1)	-2.666143455021(-3)	-7.516706386295(-1)	1.751670638629(0)
115	-7.080790962306(-1)	-2.684220492683(-3)	-7.107633167233(-1)	1.710763316723(0)
116	-6.691689791509(-1)	-2.705013729605(-3)	-6.718739928805(-1)	1.671873992880(0)
117	-6.320519051672(-1)	-2.728474381757(-3)	-6.347803795489(-1)	1.634780379549(0)
118	-5.965254776907(-1)	-2.754575584400(-3)	-5.992800532751(-1)	1.599280053275(0)
119	-5.624033017826(-1)	-2.783311485950(-3)	-5.651866132686(-1)	1.565186613269(0)
120	-5.295114950352(-1)	-2.814696879364(-3)	-5.323261919145(-1)	1.532326191915(0)
121	-4.976853953634(-1)	-2.848767363284(-3)	-5.005341627267(-1)	1.500534162727(0)
122	-4.667663063032(-1)	-2.885580053275(-3)	-4.696518863564(-1)	1.469651886356(0)
123	-4.365980981248(-1)	-2.925214894294(-3)	-4.395233130191(-1)	1.439523313019(0)
124	-4.070234363472(-1)	-2.967776661822(-3)	-4.099912130090(-1)	1.409991213009(0)
125	-3.778793245380(-1)	-3.013397784112(-3)	-3.808927223221(-1)	1.380892722322(0)
126	-3.489915000274(-1)	-3.062242175583(-3)	-3.520537422030(-1)	1.352053742203(0)
127	-3.201669600310(-1)	-3.114510345242(-3)	-3.232814703762(-1)	1.323281470376(0)
128	-2.911834226800(-1)	-3.170446134546(-3)	-2.943538688145(-1)	1.294353868815(0)
129	-2.617736333516(-1)	-3.230345533383(-3)	-2.650039788850(-1)	1.265003978885(0)
130	-2.316006391063(-1)	-3.294568058949(-3)	-2.348952071652(-1)	1.234895207165(0)
131	-2.002163177508(-1)	-3.363550928200(-3)	-2.035798686790(-1)	1.203579868679(0)
132	-1.669864394197(-1)	-3.437824857330(-3)	-1.704242642770(-1)	1.170424264277(0)
133	-1.309417458694(-1)	-3.518024432938(-3)	-1.344597703023(-1)	1.134459770302(0)
134	-9.044072560657(-2)	-3.604860545725(-3)	-9.404558615230(-2)	1.094045586152(0)
135	-4.223910494149(-2)	-3.698891582177(-3)	-4.593799652366(-2)	1.045937996524(0)
136	2.217192671317(-2)	-3.798941107278(-3)	1.837298560589(-2)	9.816270143941(-1)
137	1.684185240126(-1)	-3.864164853417(-3)	1.645543591592(-1)	8.354456408408(-1)



**Table 8**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3p_{3/2}$  ( $\mu = \pm 1/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	9.998935059903(-1)	-1.969099978383(-11)	9.998935059706(-1)	1.064904294175(-4)
2	9.995741283149(-1)	-3.149884254279(-10)	9.995741279999(-1)	4.258720001011(-4)
3	9.990421797506(-1)	-1.594059199900(-9)	9.990421781565(-1)	9.578218434576(-4)
4	9.982981806447(-1)	-5.035496331069(-9)	9.982981756092(-1)	1.701824390823(-3)
5	9.973428574987(-1)	-1.228580039128(-8)	9.973428452129(-1)	2.657154787112(-3)
6	9.961771409956(-1)	-2.545587206515(-8)	9.961771155397(-1)	3.822884460282(-3)
7	9.948021634795(-1)	-4.711653406994(-8)	9.948021163629(-1)	5.197883637071(-3)
8	9.932192559002(-1)	-8.029310573965(-8)	9.932191756071(-1)	6.780824392859(-3)
9	9.914299442380(-1)	-1.284590583716(-7)	9.914298157790(-1)	8.570184221010(-3)
10	9.894359454241(-1)	-1.955287840287(-7)	9.894357498954(-1)	1.056425010465(-2)
11	9.872391627779(-1)	-2.858495148368(-7)	9.872388769284(-1)	1.276112307158(-2)
12	9.848416809814(-1)	-4.041924338881(-7)	9.848412767890(-1)	1.515872321103(-2)
13	9.822457606143(-1)	-5.557430226256(-7)	9.822452048713(-1)	1.775479512869(-2)
14	9.794538322755(-1)	-7.460906930220(-7)	9.794530861848(-1)	2.054691381519(-2)
15	9.764684903166(-1)	-9.812177559596(-7)	9.764675090988(-1)	2.353249090116(-2)
16	9.732924862170(-1)	-1.267487779938(-6)	9.732912187292(-1)	2.670878127081(-2)
17	9.699287216285(-1)	-1.611633396596(-6)	9.699271099951(-1)	3.007289000495(-2)
18	9.663802411207(-1)	-2.020743611483(-6)	9.663782203770(-1)	3.362177962295(-2)
19	9.626502246577(-1)	-2.502250680112(-6)	9.626477224070(-1)	3.735227759298(-2)
20	9.587419798380(-1)	-3.063916610489(-6)	9.587389159213(-1)	4.126108407866(-2)
21	9.546589339288(-1)	-3.713819354131(-6)	9.546552201094(-1)	4.534477989057(-2)
22	9.504046257284(-1)	-4.460338747981(-6)	9.504001653897(-1)	4.959983461033(-2)
23	9.459826972868(-1)	-5.312142269695(-6)	9.459773851445(-1)	5.402261485548(-2)
24	9.413968855173(-1)	-6.278170668459(-6)	9.413906073466(-1)	5.860939265336(-2)
25	9.366510137306(-1)	-7.367623532820(-6)	9.366436461071(-1)	6.335635389291(-2)
26	9.317489831213(-1)	-8.589944856086(-6)	9.317403931765(-1)	6.825960682354(-2)
27	9.266947642372(-1)	-9.954808658526(-6)	9.266848094285(-1)	7.331519057146(-2)
28	9.214923884602(-1)	-1.147210472409(-5)	9.214809163555(-1)	7.851908364447(-2)
29	9.161459395720(-1)	-1.315192450750(-5)	9.161327876025(-1)	8.386721239752(-2)
30	9.106595451150(-1)	-1.500454726567(-5)	9.106445405677(-1)	8.935545943229(-2)
31	9.050373685207(-1)	-1.704042646497(-5)	9.050203280942(-1)	9.497967190581(-2)
32	8.992836004525(-1)	-1.927017651360(-5)	8.992643302760(-1)	1.007356697240(-1)
33	8.934024509616(-1)	-2.170455986585(-5)	8.933807464018(-1)	1.066192535982(-1)
34	8.873981415309(-1)	-2.435447454213(-5)	8.873737870564(-1)	1.126262129436(-1)
35	8.812748973414(-1)	-2.723094210612(-5)	8.812476663993(-1)	1.187523336007(-1)
36	8.750369397336(-1)	-3.034509613760(-5)	8.750065946375(-1)	1.249934053625(-1)
37	8.686884788793(-1)	-3.370817123643(-5)	8.686547707080(-1)	1.313452292920(-1)
38	8.622373066777(-1)	-3.733149259067(-5)	8.621963751851(-1)	1.378036248149(-1)
39	8.556767898887(-1)	-4.122646613880(-5)	8.556355634226(-1)	1.443644365774(-1)
40	8.490218635124(-1)	-4.540456935321(-5)	8.489764589431(-1)	1.510235410569(-1)
41	8.422730244254(-1)	-4.987734266965(-5)	8.422231470827(-1)	1.577768529173(-1)
42	8.354343252790(-1)	-5.465638158448(-5)	8.353796688974(-1)	1.646203311026(-1)
43	8.285097686665(-1)	-5.975332943925(-5)	8.284500153371(-1)	1.71549846629(-1)
44	8.215033015619(-1)	-6.517987090964(-5)	8.214381216910(-1)	1.785618783090(-1)
45	8.144188100326(-1)	-7.094772621381(-5)	8.143478623064(-1)	1.856521376936(-1)
46	8.072601142274(-1)	-7.706864605280(-5)	8.071830455814(-1)	1.928169544186(-1)
47	8.000309636379(-1)	-8.355440729416(-5)	7.999474092306(-1)	2.000525907694(-1)
48	7.927350326321(-1)	-9.041680940804(-5)	7.926446158227(-1)	2.073553841773(-1)
49	7.853759162556(-1)	-9.766767166360(-5)	7.852782485840(-1)	2.147217514160(-1)
50	7.779571262973(-1)	-1.053188310923(-4)	7.778518074662(-1)	2.221481925338(-1)
51	7.704820876108(-1)	-1.133821412238(-4)	7.703687054696(-1)	2.296312945304(-1)
52	7.629541346882(-1)	-1.218694715990(-4)	7.628322652166(-1)	2.371677347834(-1)
53	7.553765084739(-1)	-1.307927080649(-4)	7.552457157658(-1)	2.447542842342(-1)
54	7.477523534132(-1)	-1.401637538546(-4)	7.476121896593(-1)	2.523878103407(-1)
55	7.400847147222(-1)	-1.499945314572(-4)	7.399347201908(-1)	2.600652798092(-1)
56	7.323765358708(-1)	-1.602969852810(-4)	7.322162388855(-1)	2.677837611145(-1)
57	7.246306562645(-1)	-1.710830851153(-4)	7.244595731794(-1)	2.755404268206(-1)
58	7.168498091150(-1)	-1.823648303964(-4)	7.166674442846(-1)	2.833325557154(-1)
59	7.090366194833(-1)	-1.941542552839(-4)	7.088424652281(-1)	2.911575347719(-1)
60	7.011936024847(-1)	-2.064634345560(-4)	7.009871390501(-1)	2.990128609499(-1)
61	6.933231616373(-1)	-2.193044903335(-4)	6.931038571470(-1)	3.068961428530(-1)
62	6.854275873423(-1)	-2.326895996452(-4)	6.851948977426(-1)	3.148051022574(-1)
63	6.775090554766(-1)	-2.466310028478(-4)	6.772624244737(-1)	3.227375755263(-1)
64	6.695696260846(-1)	-2.611410129198(-4)	6.693084850717(-1)	3.306915149283(-1)
65	6.616112421487(-1)	-2.762320256482(-4)	6.613350101230(-1)	3.386649898770(-1)
66	6.536357284224(-1)	-2.919165307344(-4)	6.533438118916(-1)	3.466561881084(-1)
67	6.456447903072(-1)	-3.082071238470(-4)	6.453365831834(-1)	3.546634168166(-1)
68	6.376400127355(-1)	-3.251165196553(-4)	6.373148962338(-1)	3.626851037662(-1)
69	6.296228591642(-1)	-3.426575658833(-4)	6.292802015983(-1)	3.707197984017(-1)
70	6.215946702827(-1)	-3.608432584289(-4)	6.212338270243(-1)	3.787661729757(-1)
71	6.135566630399(-1)	-3.796867575998(-4)	6.131769762823(-1)	3.868230237177(-1)
72	6.055099293387(-1)	-3.992014055268(-4)	6.051107279331(-1)	3.948892720669(-1)
73	5.974554347510(-1)	-4.194007448214(-4)	5.970360340062(-1)	4.029639659938(-1)
74	5.893940171016(-1)	-4.402985385560(-4)	5.889537185630(-1)	4.110462814370(-1)

(continued on next page)

Table 8 (continued)

Z	$\chi_p'/X$	$\chi_p''/X$	$\chi_p/X$	$\chi_d/X$
75	5.813263849093(-1)	-4.619087916542(-4)	5.808644761177(-1)	4.191355238823(-1)
76	5.732531156590(-1)	-4.842457737927(-4)	5.727688698852(-1)	4.272311301148(-1)
77	5.651746538689(-1)	-5.073240439271(-4)	5.646673298249(-1)	4.353326701751(-1)
78	5.570913089218(-1)	-5.311584765714(-4)	5.565601504453(-1)	4.434398495547(-1)
79	5.490032526216(-1)	-5.557642899766(-4)	5.484474883316(-1)	4.515525116684(-1)
80	5.409105164336(-1)	-5.811570763749(-4)	5.403293593572(-1)	4.596706406428(-1)
81	5.328129883664(-1)	-6.073528344758(-4)	5.322056355319(-1)	4.677943644681(-1)
82	5.247104094437(-1)	-6.343680044269(-4)	5.240760414393(-1)	4.759239585607(-1)
83	5.166023697134(-1)	-6.622195054816(-4)	5.159401502080(-1)	4.840598497920(-1)
84	5.084883037330(-1)	-6.909247766458(-4)	5.077973789563(-1)	4.922026210437(-1)
85	5.003674854638(-1)	-7.205018206156(-4)	4.996469836432(-1)	5.003530163568(-1)
86	4.922390224989(-1)	-7.509692513602(-4)	4.914880532475(-1)	5.085119467525(-1)
87	4.841018495388(-1)	-7.823463457541(-4)	4.833195031930(-1)	5.166804968070(-1)
88	4.759547210192(-1)	-8.146530997182(-4)	4.751400679195(-1)	5.248599320805(-1)
89	4.677962027809(-1)	-8.479102894004(-4)	4.669482924915(-1)	5.330517075085(-1)
90	4.596246626575(-1)	-8.821395379988(-4)	4.587425231195(-1)	5.412574768805(-1)
91	4.514382598369(-1)	-9.173633889245(-4)	4.505208964480(-1)	5.494791035520(-1)
92	4.432349328344(-1)	-9.536053861058(-4)	4.422813274483(-1)	5.577186725517(-1)
93	4.350123858856(-1)	-9.908901623621(-4)	4.340214957232(-1)	5.659785042768(-1)
94	4.267680735409(-1)	-1.029243536920(-3)	4.257388300039(-1)	5.742611699961(-1)
95	4.184991832065(-1)	-1.068692623323(-3)	4.174304905832(-1)	5.825695094168(-1)
96	4.102026153338(-1)	-1.109265949190(-3)	4.090933493846(-1)	5.909066506154(-1)
97	4.018749609074(-1)	-1.150993589531(-3)	4.007239673178(-1)	5.992760326822(-1)
98	3.935124758228(-1)	-1.193907315617(-3)	3.923185685072(-1)	6.076814314928(-1)
99	3.851110516673(-1)	-1.238040761777(-3)	3.838730109055(-1)	6.161269890945(-1)
100	3.766661823279(-1)	-1.283429612906(-3)	3.753827527150(-1)	6.246172472850(-1)
101	3.681729257417(-1)	-1.330111816021(-3)	3.668428139256(-1)	6.331571860744(-1)
102	3.596258599647(-1)	-1.378127819826(-3)	3.582477321449(-1)	6.417522678551(-1)
103	3.510190325714(-1)	-1.427520847064(-3)	3.495915117243(-1)	6.504084882757(-1)
104	3.423459021874(-1)	-1.478337205392(-3)	3.408675649821(-1)	6.591324350179(-1)
105	3.335992707015(-1)	-1.530626643753(-3)	3.320686440578(-1)	6.679313559422(-1)
106	3.247712043756(-1)	-1.584442762752(-3)	3.231867616129(-1)	6.768132383871(-1)
107	3.158529416650(-1)	-1.639843489436(-3)	3.142130981755(-1)	6.857869018245(-1)
108	3.068347850369(-1)	-1.696891629370(-3)	3.051378934075(-1)	6.948621065925(-1)
109	2.977059734094(-1)	-1.75655511970(-3)	2.959503178974(-1)	7.040496821026(-1)
110	2.884545309677(-1)	-1.816209749114(-3)	2.866383212186(-1)	7.133616787814(-1)
111	2.790670869939(-1)	-1.878636132251(-3)	2.771884508617(-1)	7.228115491383(-1)
112	2.695286598666(-1)	-1.943024700081(-3)	2.675856351665(-1)	7.324143648335(-1)
113	2.598223964281(-1)	-2.009475017937(-3)	2.578129214102(-1)	7.421870785898(-1)
114	2.499292552907(-1)	-2.078097722125(-3)	2.478511575686(-1)	7.521488424314(-1)
115	2.398276190872(-1)	-2.149016398835(-3)	2.376786026884(-1)	7.623213973116(-1)
116	2.294928157883(-1)	-2.222369889704(-3)	2.272704458986(-1)	7.727295541014(-1)
117	2.188965224092(-1)	-2.298315147147(-3)	2.165982072620(-1)	7.834017927380(-1)
118	2.080060148505(-1)	-2.377030806365(-3)	2.056289840442(-1)	7.943710159558(-1)
119	1.967832138999(-1)	-2.458721703337(-3)	1.943244921966(-1)	8.056755078034(-1)
120	1.851834574399(-1)	-2.543624658871(-3)	1.826398327811(-1)	8.173601672189(-1)
121	1.731538992698(-1)	-2.632015983053(-3)	1.705218832868(-1)	8.294781167132(-1)
122	1.606313900510(-1)	-2.724221357301(-3)	1.579071686937(-1)	8.420928313063(-1)
123	1.475396263145(-1)	-2.820629064806(-3)	1.447189972497(-1)	8.552810027503(-1)
124	1.337852428513(-1)	-2.921708037504(-3)	1.308635348138(-1)	8.691364651862(-1)
125	1.192523427654(-1)	-3.028032999625(-3)	1.162243097658(-1)	8.837756902342(-1)
126	1.037946532671(-1)	-3.140320357654(-3)	1.006543329095(-1)	8.993456670905(-1)
127	8.722395744540(-2)	-3.259480886428(-3)	8.396447655897(-2)	9.160335234410(-1)
128	6.929246523596(-2)	-3.386699654078(-3)	6.590576558188(-2)	9.340942344181(-1)
129	4.966487951558(-2)	-3.523562095547(-3)	4.614131742004(-2)	9.538586825800(-1)
130	2.787199312993(-2)	-3.672262501830(-3)	2.419973062810(-2)	9.758002693719(-1)
131	3.228965097977(-3)	-3.835969556978(-3)	-6.070044590018(-4)	1.000607004459(0)
132	-2.531973459458(-2)	-4.019516741836(-3)	-2.933925133642(-2)	1.029339251336(0)
133	-5.952497508721(-2)	-4.230841264939(-3)	-6.375581635215(-2)	1.063755816352(0)
134	-1.026130990650(-1)	-4.484425577337(-3)	-1.070975246424(-1)	1.107097524642(0)
135	-1.615989092121(-1)	-4.811450651504(-3)	-1.664103598636(-1)	1.166410359864(0)
136	-2.573059862123(-1)	-5.303540614025(-3)	-2.626095268263(-1)	1.262609526826(0)
137	-6.008226480409(-1)	-6.876112744859(-3)	-6.076987607858(-1)	1.607698760786(0)



**Table 9**  
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3p_{3/2}$  ( $\mu = \pm 3/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	-5.772405534338(-14)	-1.109415527070(-6)	-1.109415584794(-6)	1.000001109416(0)
2	-9.236103450508(-13)	-4.437809809691(-6)	-4.437810733302(-6)	1.000004437811(0)
3	-4.675992202825(-12)	-9.985626002215(-6)	-9.985630678208(-6)	1.000009985631(0)
4	-1.477939515995(-11)	-1.775360286231(-5)	-1.775361764170(-5)	1.000017753618(0)
5	-3.608549225643(-11)	-2.774277500170(-5)	-2.774281108719(-5)	1.000027742811(0)
6	-7.483444217389(-11)	-3.995447323742(-5)	-3.995454807186(-5)	1.000039954548(0)
7	-1.386566108883(-10)	-5.439032504387(-5)	-5.439046370048(-5)	1.000054390464(0)
8	-2.365746777408(-10)	-7.105225510583(-5)	-7.105249168051(-5)	1.000071052492(0)
9	-3.790061270275(-10)	-8.994248597299(-5)	-8.994286497912(-5)	1.000089942865(0)
10	-5.777661264084(-10)	-1.110635388163(-4)	-1.110641165824(-4)	1.000111064117(0)
11	-8.460707936441(-10)	-1.344182342864(-4)	-1.344190803572(-4)	1.000134419080(0)
12	-1.198540853368(-9)	-1.600096934757(-4)	-1.600108920166(-4)	1.000160010892(0)
13	-1.651205685812(-9)	-1.878413389829(-4)	-1.878429901886(-4)	1.000187842990(0)
14	-2.221507769614(-9)	-2.179168960827(-4)	-2.179191175904(-4)	1.000217919118(0)
15	-2.928307521035(-9)	-2.502403939999(-4)	-2.502433223074(-4)	1.000250243322(0)
16	-3.791888532141(-9)	-2.848161672899(-4)	-2.848199591784(-4)	1.000284819959(0)
17	-4.833963210706(-9)	-3.216488573254(-4)	-3.216536912886(-4)	1.000321653691(0)
18	-6.077678824823(-9)	-3.607434138912(-4)	-3.607494915701(-4)	1.000360749492(0)
19	-7.547623955408(-9)	-4.021050968877(-4)	-4.021126445117(-4)	1.000402112645(0)
20	-9.269835360034(-9)	-4.457394781444(-4)	-4.457487479798(-4)	1.000445748748(0)
21	-1.127180525173(-8)	-4.916524433444(-4)	-4.916637151496(-4)	1.000491663715(0)
22	-1.358248899665(-8)	-5.398501940616(-4)	-5.398637765506(-4)	1.000539863777(0)
23	-1.623231323463(-8)	-5.903392499115(-4)	-5.903554822247(-4)	1.000590355482(0)
24	-1.925318442716(-8)	-6.431264508174(-4)	-6.431457040018(-4)	1.000643145704(0)
25	-2.267849783713(-8)	-6.982189593932(-4)	-6.982416378910(-4)	1.000698241638(0)
26	-2.654314694541(-8)	-7.556242634447(-4)	-7.556508065917(-4)	1.000755650807(0)
27	-3.088353330910(-8)	-8.153501785913(-4)	-8.153810621247(-4)	1.000815381062(0)
28	-3.573757686706(-8)	-8.774048510089(-4)	-8.774405885858(-4)	1.000877440589(0)
29	-4.114472669808(-8)	-9.417967602972(-4)	-9.418379050239(-4)	1.000941837905(0)
30	-4.714597223770(-8)	-1.008534722472(-3)	-1.008581868445(-3)	1.001008581868(0)
31	-5.378385495969(-8)	-1.077627893088(-3)	-1.077681676943(-3)	1.001077681677(0)
32	-6.110248052875(-8)	-1.149085770485(-3)	-1.149146872965(-3)	1.001149146873(0)
33	-6.914753143097(-8)	-1.222918199174(-3)	-1.222987346705(-3)	1.001222987347(0)
34	-7.796628008908(-8)	-1.299135373354(-3)	-1.299213339634(-3)	1.001299213340(0)
35	-8.760760246986(-8)	-1.377747840567(-3)	-1.377835448170(-3)	1.001377835448(0)
36	-9.812192919107(-8)	-1.458766505489(-3)	-1.458864627481(-3)	1.001458864627(0)
37	-1.095615751360(-7)	-1.542202633868(-3)	-1.542312195443(-3)	1.001542312195(0)
38	-1.219801245839(-7)	-1.628067856607(-3)	-1.628189836731(-3)	1.001628189837(0)
39	-1.354330768641(-7)	-1.716374173989(-3)	-1.716509607065(-3)	1.001716509607(0)
40	-1.499775475444(-7)	-1.807133960060(-3)	-1.807283937608(-3)	1.001807283938(0)
41	-1.656723481603(-7)	-1.900359967165(-3)	-1.900525639513(-3)	1.001900525640(0)
42	-1.825780034975(-7)	-1.996065330634(-3)	-1.996247908638(-3)	1.001996247909(0)
43	-2.007567694354(-7)	-2.094263573641(-3)	-2.094464330411(-3)	1.002094464330(0)
44	-2.202726513634(-7)	-2.194968612217(-3)	-2.195188884868(-3)	1.002195188885(0)
45	-2.411914231788(-7)	-2.298194760433(-3)	-2.298435951857(-3)	1.002298435952(0)
46	-2.635806468802(-7)	-2.403956735765(-3)	-2.404220316412(-3)	1.002404220316(0)
47	-2.875096927652(-7)	-2.512269664617(-3)	-2.512557174310(-3)	1.002512557174(0)
48	-3.130497602453(-7)	-2.623149088040(-3)	-2.623462137800(-3)	1.002623462138(0)
49	-3.402738992913(-7)	-2.736610967626(-3)	-2.736951241525(-3)	1.002736951242(0)
50	-3.692570325197(-7)	-2.852671691596(-3)	-2.853040948629(-3)	1.002853040949(0)
51	-4.000759779364(-7)	-2.971348081077(-3)	-2.971748157055(-3)	1.002971748157(0)
52	-4.328094723479(-7)	-3.092657396581(-3)	-3.093090206054(-3)	1.003093090206(0)
53	-4.675381954574(-7)	-3.216617344683(-3)	-3.217084882879(-3)	1.003217084883(0)
54	-5.043447946583(-7)	-3.343246084912(-3)	-3.343750429707(-3)	1.003343750430(0)
55	-5.433139105413(-7)	-3.472562236853(-3)	-3.473105550763(-3)	1.003473105551(0)
56	-5.845322031308(-7)	-3.604584887466(-3)	-3.605169419669(-3)	1.003605169420(0)
57	-6.280883788663(-7)	-3.739333598639(-3)	-3.739961687018(-3)	1.003739961687(0)
58	-6.740732183463(-7)	-3.876828414958(-3)	-3.877502488177(-3)	1.003877502488(0)
59	-7.225796048522(-7)	-4.017089871728(-3)	-4.017812451333(-3)	1.004017812451(0)
60	-7.737025536698(-7)	-4.160139003229(-3)	-4.160912705783(-3)	1.004160912706(0)
61	-8.275392422268(-7)	-4.305997351226(-3)	-4.306824890469(-3)	1.004306824890(0)
62	-8.841890410672(-7)	-4.454686973736(-3)	-4.455571162777(-3)	1.004455711627(0)
63	-9.437535456805(-7)	-4.606230454057(-3)	-4.607174207603(-3)	1.004607174208(0)
64	-1.006336609208(-6)	-4.760650910077(-3)	-4.761657246686(-3)	1.004761657247(0)
65	-1.072044376049(-6)	-4.917972003850(-3)	-4.919044048226(-3)	1.004919044048(0)
66	-1.140985316381(-6)	-5.078217951474(-3)	-5.079358936791(-3)	1.005079358937(0)
67	-1.213270261632(-6)	-5.241413533256(-3)	-5.242626803517(-3)	1.005242626804(0)
68	-1.289012440914(-6)	-5.407584104181(-3)	-5.408873116622(-3)	1.005408873117(0)
69	-1.368327518447(-6)	-5.576755604708(-3)	-5.578123932226(-3)	1.005578123932(0)
70	-1.451333632006(-6)	-5.748954571871(-3)	-5.750405905503(-3)	1.005750405906(0)
71	-1.538151432405(-6)	-5.924208150728(-3)	-5.925746302160(-3)	1.005925746302(0)
72	-1.628904124059(-6)	-6.102544106147(-3)	-6.104173010271(-3)	1.006104173010(0)
73	-1.723717506633(-6)	-6.283990834947(-3)	-6.285714552453(-3)	1.006285714552(0)
74	-1.822720017836(-6)	-6.468577378401(-3)	-6.470400098419(-3)	1.006470400098(0)

(continued on next page)

Table 9 (continued)

Z	$\chi_p'/X$	$\chi_p''/X$	$\chi_p/X$	$\chi_a/X$
75	-1.926042777358(-6)	-6.656333435121(-3)	-6.658259477898(-3)	1.006658259478(0)
76	-2.033819632006(-6)	-6.847289374325(-3)	-6.849323193957(-3)	1.006849323194(0)
77	-2.146187202062(-6)	-7.041476249510(-3)	-7.043622436712(-3)	1.007043622437(0)
78	-2.263284928889(-6)	-7.238925812528(-3)	-7.241189097457(-3)	1.007241189097(0)
79	-2.385255123844(-6)	-7.439670528101(-3)	-7.442055783225(-3)	1.007442055783(0)
80	-2.512243018499(-6)	-7.643743588764(-3)	-7.646255831782(-3)	1.007646255832(0)
81	-2.644396816242(-6)	-7.851178930268(-3)	-7.853823327084(-3)	1.007853823327(0)
82	-2.781867745274(-6)	-8.062011247453(-3)	-8.064793115199(-3)	1.008064793115(0)
83	-2.924810113050(-6)	-8.276276010601(-3)	-8.279200820714(-3)	1.008279200821(0)
84	-3.073381362209(-6)	-8.494009482290(-3)	-8.497082863652(-3)	1.008497082864(0)
85	-3.227742128030(-6)	-8.715248734767(-3)	-8.718476476895(-3)	1.008718476477(0)
86	-3.388056297461(-6)	-8.940031667856(-3)	-8.943419724154(-3)	1.008943419724(0)
87	-3.554491069768(-6)	-9.168397027414(-3)	-9.171951518484(-3)	1.009171951518(0)
88	-3.727217018855(-6)	-9.400384424362(-3)	-9.404111641381(-3)	1.009404111641(0)
89	-3.906408157299(-6)	-9.636034354306(-3)	-9.639940762463(-3)	1.009639940762(0)
90	-4.092242002157(-6)	-9.875388217766(-3)	-9.879480459768(-3)	1.009879480460(0)
91	-4.284899642597(-6)	-1.011848834105(-2)	-1.012277324069(-2)	1.010122773241(0)
92	-4.484565809405(-6)	-1.036537799774(-2)	-1.036986256355(-2)	1.010369862564(0)
93	-4.691428946437(-6)	-1.061610143095(-2)	-1.062079285990(-2)	1.010620792860(0)
94	-4.905681284063(-6)	-1.087070387616(-2)	-1.087560955744(-2)	1.010875609557(0)
95	-5.127518914677(-6)	-1.112923158486(-2)	-1.113435910377(-2)	1.011134359104(0)
96	-5.357141870324(-6)	-1.139173184894(-2)	-1.139708899081(-2)	1.011397088991(0)
97	-5.594754202535(-6)	-1.165825302584(-2)	-1.166384778004(-2)	1.011663847780(0)
98	-5.840564064408(-6)	-1.192884456450(-2)	-1.193468512857(-2)	1.011934685129(0)
99	-6.094783795041(-6)	-1.220355703217(-2)	-1.220965181597(-2)	1.012209651816(0)
100	-6.357630006368(-6)	-1.248244214208(-2)	-1.248879977209(-2)	1.012488799772(0)
101	-6.629323672486(-6)	-1.276555278200(-2)	-1.277218210567(-2)	1.012772182106(0)
102	-6.910090221563(-6)	-1.305294304376(-2)	-1.305985313398(-2)	1.013059853134(0)
103	-7.200159630394(-6)	-1.334466825370(-2)	-1.335186841333(-2)	1.013351868413(0)
104	-7.499766521712(-6)	-1.364078500416(-2)	-1.364828477068(-2)	1.013648284771(0)
105	-7.809150264337(-6)	-1.394135118600(-2)	-1.394916033627(-2)	1.013949160336(0)
106	-8.128555076252(-6)	-1.424642602220(-2)	-1.425455457728(-2)	1.014254554577(0)
107	-8.458230130731(-6)	-1.455607010259(-2)	-1.456452833272(-2)	1.014564528333(0)
108	-8.798429665589(-6)	-1.487034541974(-2)	-1.487914384941(-2)	1.014879143849(0)
109	-9.149413095694(-6)	-1.518931540609(-2)	-1.519846481919(-2)	1.015198464819(0)
110	-9.511445128832(-6)	-1.551304497231(-2)	-1.552255641744(-2)	1.015522556417(0)
111	-9.884795885054(-6)	-1.584160054698(-2)	-1.585148534287(-2)	1.015851485343(0)
112	-1.026974101963(-5)	-1.617505011765(-2)	-1.618531985867(-2)	1.016185319859(0)
113	-1.066656184972(-5)	-1.651346327329(-2)	-1.652412983514(-2)	1.016524129835(0)
114	-1.107554548492(-5)	-1.685691124826(-2)	-1.686798679374(-2)	1.016867986794(0)
115	-1.149698496182(-5)	-1.720546696774(-2)	-1.721696395270(-2)	1.017216963953(0)
116	-1.193117938268(-5)	-1.755920509486(-2)	-1.757113627424(-2)	1.017571136274(0)
117	-1.237843405843(-5)	-1.791820207938(-2)	-1.793058051344(-2)	1.017930580513(0)
118	-1.283906065615(-5)	-1.828253620820(-2)	-1.829537526886(-2)	1.018295375269(0)
119	-1.331337735109(-5)	-1.865228765762(-2)	-1.866560103497(-2)	1.018665601035(0)
120	-1.380170898360(-5)	-1.902753854745(-2)	-1.904134025643(-2)	1.019041340256(0)
121	-1.430438722099(-5)	-1.940837299719(-2)	-1.942267738441(-2)	1.019422677384(0)
122	-1.482175072449(-5)	-1.979487718411(-2)	-1.980969893484(-2)	1.019809698935(0)
123	-1.535414532169(-5)	-2.018713940358(-2)	-2.020249354890(-2)	1.020202493549(0)
124	-1.590192418447(-5)	-2.058525013152(-2)	-2.060115205570(-2)	1.020601152056(0)
125	-1.646544801277(-5)	-2.098930208925(-2)	-2.100576753726(-2)	1.021005767537(0)
126	-1.704508522431(-5)	-2.139939031069(-2)	-2.141643539591(-2)	1.021416435396(0)
127	-1.764121215062(-5)	-2.181561221212(-2)	-2.183325342428(-2)	1.021833253424(0)
128	-1.825421323955(-5)	-2.223806766459(-2)	-2.225632187783(-2)	1.022256321878(0)
129	-1.888448126454(-5)	-2.266685906900(-2)	-2.268574355026(-2)	1.022685743550(0)
130	-1.953241754088(-5)	-2.310209143414(-2)	-2.312162385169(-2)	1.023121623852(0)
131	-2.019843214936(-5)	-2.354387245774(-2)	-2.356407088989(-2)	1.023564070890(0)
132	-2.088294416747(-5)	-2.399231261054(-2)	-2.401319555471(-2)	1.024013195555(0)
133	-2.158638190859(-5)	-2.444752522379(-2)	-2.446911160570(-2)	1.024469111606(0)
134	-2.230918316937(-5)	-2.490962658010(-2)	-2.493193576327(-2)	1.024931935763(0)
135	-2.305179548577(-5)	-2.537873600792(-2)	-2.540178780341(-2)	1.025401787803(0)
136	-2.381467639804(-5)	-2.585497597973(-2)	-2.587879065613(-2)	1.025878790656(0)
137	-2.459829372508(-5)	-2.633847221425(-2)	-2.636307050797(-2)	1.026363070508(0)

Table 10

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3d_{3/2}$  ( $\mu = \pm 1/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	1.000023010333(0)	3.646856262095(-12)	1.000023010336(0)	-2.301033632634(-5)
2	1.000092047189(0)	5.835517425949(-11)	1.000092047247(0)	-9.204724717665(-5)
3	1.000207128146(0)	2.954692662098(-10)	1.000207128442(0)	-2.071284419574(-4)
4	1.000368282515(0)	9.340332576674(-10)	1.000368283449(0)	-3.682834489926(-4)
5	1.000575551354(0)	2.280996693449(-9)	1.000575553635(0)	-5.755536345099(-4)
6	1.000828987498(0)	4.731502782621(-9)	1.000828992229(0)	-8.289922292520(-4)
7	1.001128655593(0)	8.769259680222(-9)	1.001128664363(0)	-1.128664362748(-3)
8	1.001474632138(0)	1.496699531841(-8)	1.001474647105(0)	-1.474647105281(-3)
9	1.001867005531(0)	2.398699641577(-8)	1.001867029518(0)	-1.867029517612(-3)
10	1.002305876127(0)	3.658173241097(-8)	1.002305912709(0)	-2.305912708504(-3)
11	1.002791356306(0)	5.359456518575(-8)	1.002791409900(0)	-2.791409900133(-3)
12	1.003323570541(0)	7.596054556292(-8)	1.003323646501(0)	-3.323646501460(-3)
13	1.003902655482(0)	1.047072976881(-7)	1.003902760190(0)	-3.902760189637(-3)
14	1.004528760044(0)	1.409559925281(-7)	1.004528901000(0)	-4.528900999576(-3)
15	1.005202045499(0)	1.859224118481(-7)	1.005202231422(0)	-5.202231421763(-3)
16	1.005922685590(0)	2.409181041581(-7)	1.005922926508(0)	-5.922926508451(-3)
17	1.006690866637(0)	3.073516342542(-7)	1.006691173988(0)	-6.691173988357(-3)
18	1.007506787660(0)	3.867299281172(-7)	1.007507174390(0)	-7.507174390006(-3)
19	1.008370660514(0)	4.806597150715(-7)	1.008371141174(0)	-8.371141173876(-3)
20	1.009282710024(0)	5.908490692501(-7)	1.009283300874(0)	-9.283300873502(-3)
21	1.010243174137(0)	7.191090525662(-7)	1.010243893246(0)	-1.024389324572(-2)
22	1.011252304075(0)	8.673554615371(-7)	1.011253171430(0)	-1.125317143024(-2)
23	1.012310364508(0)	1.037610680475(-6)	1.012311402119(0)	-1.231140211873(-2)
24	1.013417633728(0)	1.232005643714(-6)	1.013418865734(0)	-1.341886573367(-2)
25	1.014574403835(0)	1.452781909719(-6)	1.014575856617(0)	-1.457585661715(-2)
26	1.015780980936(0)	1.702293850099(-6)	1.015782683230(0)	-1.578268322985(-2)
27	1.017037685350(0)	1.983010956726(-6)	1.017039668361(0)	-1.703966836056(-2)
28	1.018344851826(0)	2.297520270346(-6)	1.018347149346(0)	-1.834714934634(-2)
29	1.019702829775(0)	2.648528934288(-6)	1.019705478304(0)	-1.970547830375(-2)
30	1.021111983505(0)	3.038866877055(-6)	1.021115022371(0)	-2.111502237138(-2)
31	1.022572692474(0)	3.471489627814(-6)	1.022576163964(0)	-2.257616396405(-2)
32	1.024085351558(0)	3.949481269011(-6)	1.024089301039(0)	-2.408930103890(-2)
33	1.025650371316(0)	4.476057530591(-6)	1.025654847374(0)	-2.565484737392(-2)
34	1.027268178290(0)	5.054569030521(-6)	1.027273232859(0)	-2.727323285905(-2)
35	1.028939215296(0)	5.688504666592(-6)	1.028944903800(0)	-2.894490380047(-2)
36	1.030663941743(0)	6.381495164716(-6)	1.030670323238(0)	-3.067032323835(-2)
37	1.032442833962(0)	7.137316789241(-6)	1.032449971279(0)	-3.244997127852(-2)
38	1.034276385543(0)	7.959895221079(-6)	1.034284345439(0)	-3.428434543858(-2)
39	1.036165107699(0)	8.853309609745(-6)	1.036173961009(0)	-3.617396100881(-2)
40	1.038109529632(0)	9.821796805740(-6)	1.038119351429(0)	-3.811935142856(-2)
41	1.040110198923(0)	1.086975578004(-5)	1.040121068678(0)	-4.012106867841(-2)
42	1.042167681937(0)	1.200175223781(-5)	1.042179683689(0)	-4.217968368893(-2)
43	1.044282564243(0)	1.322252343377(-5)	1.044295786766(0)	-4.429578676641(-2)
44	1.046455451053(0)	1.453698319722(-5)	1.046469988036(0)	-4.646998803628(-2)
45	1.048686967678(0)	1.595022717479(-5)	1.048702917905(0)	-4.870291790479(-2)
46	1.050977760002(0)	1.746753829987(-5)	1.050995227540(0)	-5.099522753982(-2)
47	1.053328494979(0)	1.909439249769(-5)	1.053347589371(0)	-5.334758937118(-2)
48	1.055739861147(0)	2.083646463578(-5)	1.055760697612(0)	-5.576069761161(-2)
49	1.058212569164(0)	2.269963472987(-5)	1.058235268799(0)	-5.823526879880(-2)
50	1.060747352365(0)	2.468999441608(-5)	1.060772042360(0)	-6.0772042360(-2)
51	1.063344967343(0)	2.681385370032(-5)	1.063371781197(0)	-6.337178119719(-2)
52	1.066006194554(0)	2.907774799703(-5)	1.066035272302(0)	-6.603527230199(-2)
53	1.068731838942(0)	3.148844546948(-5)	1.068763327388(0)	-6.876332738751(-2)
54	1.071522730597(0)	3.405295468472(-5)	1.071556783552(0)	-7.155678355191(-2)
55	1.074379725434(0)	3.677853259713(-5)	1.074416503967(0)	-7.441650396655(-2)
56	1.077303705900(0)	3.967269287480(-5)	1.077343378592(0)	-7.734337859250(-2)
57	1.080295581712(0)	4.274321458429(-5)	1.080338324926(0)	-8.033832492617(-2)
58	1.083356290624(0)	4.599815124960(-5)	1.083402288775(0)	-8.340228877548(-2)
59	1.086486799227(0)	4.944584030250(-5)	1.086536245068(0)	-8.653624506762(-2)
60	1.089688103777(0)	5.309491294194(-5)	1.089741198690(0)	-8.974119868998(-2)
61	1.092961231061(0)	5.695430442145(-5)	1.093018185366(0)	-9.301818536557(-2)
62	1.096307239300(0)	6.103326478428(-5)	1.096368272564(0)	-9.636827256446(-2)
63	1.099727219083(0)	6.534137006734(-5)	1.099792560453(0)	-9.979256045290(-2)
64	1.10322294348(0)	6.988853399578(-5)	1.103292182882(0)	-1.032921828817(-1)
65	1.106793623396(0)	7.468502019180(-5)	1.106868308416(0)	-1.068683084159(-1)
66	1.110442399952(0)	7.974145492198(-5)	1.110522141407(0)	-1.105221414071(-1)
67	1.114169854270(0)	8.506884040922(-5)	1.114254923111(0)	-1.142549231107(-1)
68	1.117977254282(0)	9.067856873666(-5)	1.118067932851(0)	-1.180679328508(-1)
69	1.121865906797(0)	9.658243637242(-5)	1.121962489233(0)	-1.219624892334(-1)
70	1.125837158753(0)	1.027926593459(-4)	1.125939951412(0)	-1.259399514120(-1)
71	1.129892398517(0)	1.093218891077(-4)	1.130001720406(0)	-1.300017204060(-1)
72	1.134033057248(0)	1.161832291076(-4)	1.134149240477(0)	-1.341492404771(-1)
73	1.138260610312(0)	1.233902521264(-4)	1.138384000564(0)	-1.383840005638(-1)
74	1.142576578760(0)	1.309570184002(-4)	1.142707535778(0)	-1.427075357784(-1)

(continued on next page)



Table 10 (continued)

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
75	1.146982530875(0)	1.388980945770(-4)	1.147121428970(0)	-1.471214289697(-1)
76	1.151480083780(0)	1.472285735491(-4)	1.151627312353(0)	-1.516273123531(-1)
77	1.156070905118(0)	1.559640952064(-4)	1.156226869213(0)	-1.562268692132(-1)
78	1.160756714814(0)	1.651208681577(-4)	1.160921835682(0)	-1.609218356819(-1)
79	1.165539286903(0)	1.747156924731(-4)	1.165714002595(0)	-1.657140025950(-1)
80	1.170420451450(0)	1.847659834988(-4)	1.170605217433(0)	-1.706052174331(-1)
81	1.175402096552(0)	1.952897968032(-4)	1.175597386349(0)	-1.755973863486(-1)
82	1.180486170432(0)	2.063058543152(-4)	1.180692476287(0)	-1.806924762866(-1)
83	1.185674683629(0)	2.178335717178(-4)	1.185892517201(0)	-1.858925172006(-1)
84	1.190969711285(0)	2.298930871662(-4)	1.191199604372(0)	-1.911996043721(-1)
85	1.196373395544(0)	2.425052914040(-4)	1.196615900836(0)	-1.966159008359(-1)
86	1.201887948060(0)	2.556918593526(-4)	1.202143639920(0)	-2.021436399197(-1)
87	1.207515652619(0)	2.694752832579(-4)	1.207785127902(0)	-2.077851279024(-1)
88	1.213258867890(0)	2.838789074810(-4)	1.213542746798(0)	-2.135427467977(-1)
89	1.219120030306(0)	2.989269650251(-4)	1.219418957271(0)	-2.194189572710(-1)
90	1.225101657080(0)	3.146446158991(-4)	1.225416301696(0)	-2.254163016959(-1)
91	1.231206349370(0)	3.310579874213(-4)	1.231537407358(0)	-2.315374073576(-1)
92	1.237436795597(0)	3.481942165780(-4)	1.237784989813(0)	-2.377849898134(-1)
93	1.243795774923(0)	3.660814945538(-4)	1.244161856417(0)	-2.441618564173(-1)
94	1.250286160905(0)	3.847491135639(-4)	1.250670910019(0)	-2.506709100186(-1)
95	1.256910925329(0)	4.042275161229(-4)	1.257315152845(0)	-2.573151528450(-1)
96	1.263673142233(0)	4.245483468965(-4)	1.264097690580(0)	-2.640976905803(-1)
97	1.270575992142(0)	4.457445072905(-4)	1.271021736649(0)	-2.710217366490(-1)
98	1.277622766505(0)	4.678502129445(-4)	1.278090616718(0)	-2.780906167178(-1)
99	1.284816872376(0)	4.909010543060(-4)	1.285307773430(0)	-2.853077734302(-1)
100	1.292161837325(0)	5.149340604766(-4)	1.292676771385(0)	-2.926767713852(-1)
101	1.299661314610(0)	5.399877665318(-4)	1.300201302377(0)	-3.002013023767(-1)
102	1.307319088624(0)	5.661022845333(-4)	1.307885190908(0)	-3.078851909084(-1)
103	1.315139080623(0)	5.933193784663(-4)	1.315732400002(0)	-3.157324000019(-1)
104	1.323125354773(0)	6.216825433519(-4)	1.323747037316(0)	-3.237470373160(-1)
105	1.331282124508(0)	6.512370888027(-4)	1.331933361597(0)	-3.319333615966(-1)
106	1.339613759250(0)	6.820302273090(-4)	1.340295789477(0)	-3.402957894775(-1)
107	1.348124791488(0)	7.141111675656(-4)	1.348838902656(0)	-3.488389026558(-1)
108	1.356819924251(0)	7.475312131696(-4)	1.357567455465(0)	-3.575674554646(-1)
109	1.365704039002(0)	7.823438670473(-4)	1.366486382870(0)	-3.664863828700(-1)
110	1.374782203974(0)	8.186049419937(-4)	1.375600808916(0)	-3.756008089163(-1)
111	1.384059682982(0)	8.563726777373(-4)	1.384916055659(0)	-3.849160556593(-1)
112	1.393541944738(0)	8.957078649755(-4)	1.394437652603(0)	-3.944376526028(-1)
113	1.403234672713(0)	9.366739768600(-4)	1.404171346689(0)	-4.041713466894(-1)
114	1.413143775563(0)	9.793373084481(-4)	1.414123112872(0)	-4.141231128719(-1)
115	1.423275398185(0)	1.023767124677(-3)	1.424299165309(0)	-4.242991653094(-1)
116	1.433635933410(0)	1.070035817464(-3)	1.434705969228(0)	-4.347059692278(-1)
117	1.444232034420(0)	1.118219072576(-3)	1.445350253493(0)	-4.453502534929(-1)
118	1.455070627896(0)	1.168396046977(-3)	1.456239023943(0)	-4.562390239429(-1)
119	1.466158927976(0)	1.220649557397(-3)	1.467379577533(0)	-4.673795775329(-1)
120	1.477504451066(0)	1.275066280948(-3)	1.478779517347(0)	-4.787795173474(-1)
121	1.489115031570(0)	1.331736968662(-3)	1.490446768539(0)	-4.904467685390(-1)
122	1.500998838582(0)	1.390756672891(-3)	1.502389595255(0)	-5.023895952552(-1)
123	1.513164393627(0)	1.452224989589(-3)	1.514616618617(0)	-5.146166186171(-1)
124	1.525620589497(0)	1.516246316561(-3)	1.527136835814(0)	-5.271368358139(-1)
125	1.538376710248(0)	1.582930128828(-3)	1.539959640377(0)	-5.399596403773(-1)
126	1.551442452415(0)	1.652391272293(-3)	1.553094843687(0)	-5.530948436872(-1)
127	1.564827947472(0)	1.724750276963(-3)	1.566552697749(0)	-5.665526977490(-1)
128	1.578543785549(0)	1.800133690861(-3)	1.580343919240(0)	-5.803439192398(-1)
129	1.592601040312(0)	1.878674435656(-3)	1.594479714748(0)	-5.944797147477(-1)
130	1.607011294781(0)	1.960512184482(-3)	1.608971806966(0)	-6.089718069656(-1)
131	1.621786667486(0)	2.045793761238(-3)	1.623832461248(0)	-6.238324612477(-1)
132	1.636939837535(0)	2.134673557599(-3)	1.639074511092(0)	-6.390745110923(-1)
133	1.652484064927(0)	2.227313955708(-3)	1.654711378883(0)	-6.547113788828(-1)
134	1.668433195569(0)	2.323885718695(-3)	1.6707570812875(0)	-6.707570812875(-1)
135	1.684801613257(0)	2.424568209556(-3)	1.687226181466(0)	-6.872261814661(-1)
136	1.701603939118(0)	2.529548695599(-3)	1.704133487814(0)	-7.041334878139(-1)
137	1.718850208709(0)	2.639004946810(-3)	1.721489213656(0)	-7.214892136557(-1)



Table 11

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3d_{3/2}$  ( $\mu = \pm 3/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	1.000051774697(0)	4.923397564896(-11)	1.000051774746(0)	-5.177474592480(-5)
2	1.000207129350(0)	7.878855052924(-10)	1.000207130138(0)	-2.071301381949(-4)
3	1.000466155696(0)	3.989868098027(-9)	1.000466159686(0)	-4.661596863418(-4)
4	1.000829006778(0)	1.261525631864(-8)	1.000829019393(0)	-8.290193931917(-4)
5	1.001295897170(0)	3.081562453750(-8)	1.001295927986(0)	-1.295927985720(-3)
6	1.001867103298(0)	6.394154258041(-8)	1.001867167239(0)	-1.867167239136(-3)
7	1.002542963843(0)	1.185522497928(-7)	1.002543082395(0)	-2.543082395093(-3)
8	1.003323880248(0)	2.024275353440(-7)	1.003324082675(0)	-3.324082675178(-3)
9	1.004210317309(0)	3.245818590348(-7)	1.004210641891(0)	-4.210641891100(-3)
10	1.005202803873(0)	4.952807534595(-7)	1.005203299153(0)	-5.203299153290(-3)
11	1.006301933620(0)	7.260595551516(-7)	1.006302659680(0)	-6.302659679865(-3)
12	1.007508365964(0)	1.029744519332(-6)	1.007509395708(0)	-7.509395708244(-3)
13	1.008822827036(0)	1.420476380122(-6)	1.008824247512(0)	-8.824247511978(-3)
14	1.010246110789(0)	1.913736425597(-6)	1.010248024526(0)	-1.024802452567(-2)
15	1.011779080206(0)	2.526375164927(-6)	1.011781606581(0)	-1.178160658121(-2)
16	1.013422668615(0)	3.276643673023(-6)	1.013425945259(0)	-1.342594525911(-2)
17	1.015177881129(0)	4.184227706739(-6)	1.015182065357(0)	-1.518206535685(-2)
18	1.017045796200(0)	5.270284695717(-6)	1.017051066485(0)	-1.705106648471(-2)
19	1.019027567300(0)	6.557483720511(-6)	1.019034124783(0)	-1.903412478328(-2)
20	1.021124424730(0)	8.070048600704(-6)	1.021132494778(0)	-2.113249477829(-2)
21	1.023337677568(0)	9.833804226425(-6)	1.023347511372(0)	-2.334751137196(-2)
22	1.025668715753(0)	1.187622627799(-5)	1.025680591979(0)	-2.568059197991(-2)
23	1.028119012318(0)	1.422649449047(-5)	1.028133238813(0)	-2.813323881296(-2)
24	1.030690125782(0)	1.691554963285(-5)	1.030707041332(0)	-3.070704133171(-2)
25	1.033383702692(0)	1.997615438502(-5)	1.033403678847(0)	-3.340367884657(-2)
26	1.036201480348(0)	2.344295831078(-5)	1.036224923306(0)	-3.622492330649(-2)
27	1.039145289697(0)	2.735256714034(-5)	1.039172642264(0)	-3.917264226408(-2)
28	1.042217058417(0)	3.174361659294(-5)	1.042248802034(0)	-4.224880203386(-2)
29	1.045418814202(0)	3.665685098804(-5)	1.045455471053(0)	-4.545547105270(-2)
30	1.048752688247(0)	4.213520691316(-5)	1.048794823454(0)	-4.879482345385(-2)
31	1.052220918964(0)	4.822390223690(-5)	1.052269142866(0)	-5.226914286610(-2)
32	1.05582585921(0)	5.497053077882(-5)	1.055880826451(0)	-5.588082645137(-2)
33	1.059569964031(0)	6.242516297128(-5)	1.059632389194(0)	-5.963238919426(-2)
34	1.063455828006(0)	7.064045287540(-5)	1.063526468459(0)	-6.352646845874(-2)
35	1.067486157076(0)	7.967175194077(-5)	1.067565828828(0)	-6.756582882798(-2)
36	1.071663790015(0)	8.957722992990(-5)	1.071753367245(0)	-7.175336724474(-2)
37	1.075991700468(0)	1.004180034610(-4)	1.076092118471(0)	-7.609211847109(-2)
38	1.080473002615(0)	1.122582726589(-4)	1.080585260888(0)	-8.058526088766(-2)
39	1.085110957188(0)	1.251654664428(-4)	1.085236122654(0)	-8.523612265423(-2)
40	1.089908977858(0)	1.392103970226(-4)	1.090048188255(0)	-9.0004818825531(-2)
41	1.094870638032(0)	1.544674242195(-4)	1.095025105456(0)	-9.502510545615(-2)
42	1.099999678066(0)	1.710146302805(-4)	1.100170692697(0)	-1.001706926967(-1)
43	1.105300012947(0)	1.889340059064(-4)	1.105488946953(0)	-1.105488946953(-1)
44	1.110775740452(0)	2.083116482764(-4)	1.110984052100(0)	-1.109840521000(-1)
45	1.116431149834(0)	2.292379719154(-4)	1.116660387806(0)	-1.166603878063(-1)
46	1.122270731072(0)	2.518079333205(-4)	1.122522539005(0)	-1.225225390051(-1)
47	1.128299184706(0)	2.761212703436(-4)	1.128575305976(0)	-1.285753059763(-1)
48	1.134521432331(0)	3.022827574081(-4)	1.134823715089(0)	-1.348237150885(-1)
49	1.140942627769(0)	3.304024777341(-4)	1.141273030246(0)	-1.412730302463(-1)
50	1.147568168983(0)	3.605961138463(-4)	1.147928765097(0)	-1.479287650973(-1)
51	1.154403710798(0)	3.929852577525(-4)	1.154796696056(0)	-1.547966960559(-1)
52	1.161455178462(0)	4.276977423021(-4)	1.161882876205(0)	-1.618828762046(-1)
53	1.168728782146(0)	4.648679953705(-4)	1.169193650142(0)	-1.691936501418(-1)
54	1.176231032432(0)	5.046374186639(-4)	1.176735669850(0)	-1.767356698504(-1)
55	1.183968756872(0)	5.471547931033(-4)	1.184515911666(0)	-1.845159116656(-1)
56	1.191949117720(0)	5.925767129281(-4)	1.192541694433(0)	-1.925416944334(-1)
57	1.200179630902(0)	6.410680508602(-4)	1.200820698953(0)	-2.008206989532(-1)
58	1.208668186352(0)	6.928024568896(-4)	1.209360988808(0)	-2.093609888085(-1)
59	1.217423069818(0)	7.479628934899(-4)	1.218171032712(0)	-2.181710327116(-1)
60	1.226452986260(0)	8.067422103430(-4)	1.227259728470(0)	-2.272597284701(-1)
61	1.235767084972(0)	8.693437619529(-4)	1.236636428733(0)	-2.366364287335(-1)
62	1.245374986589(0)	9.359820718673(-4)	1.246310968660(0)	-2.463109686604(-1)
63	1.255286812133(0)	1.006883547594(-3)	1.256293695680(0)	-2.562936956805(-1)
64	1.265513214282(0)	1.082287250719(-3)	1.266595501533(0)	-2.665955015325(-1)
65	1.276065411059(0)	1.162445727198(-3)	1.277227856787(0)	-2.772278567865(-1)
66	1.286955222169(0)	1.247625903301(-3)	1.288202848072(0)	-2.882028480724(-1)
67	1.298195108213(0)	1.338110053285(-3)	1.299533218266(0)	-2.995332182662(-1)
68	1.309798213064(0)	1.434196845510(-3)	1.311232409910(0)	-3.112324099917(-1)
69	1.321778409694(0)	1.536202474432(-3)	1.323314612169(0)	-3.233146121686(-1)
70	1.334150349783(0)	1.644461886752(-3)	1.335794811670(0)	-3.357948116696(-1)
71	1.346929517482(0)	1.759330110891(-3)	1.348688847593(0)	-3.486888475929(-1)
72	1.360132287741(0)	1.881183700014(-3)	1.362013471441(0)	-3.620134714410(-1)
73	1.373775989650(0)	2.010422300006(-3)	1.375786411950(0)	-3.757864119504(-1)
74	1.387878975315(0)	2.147470355095(-3)	1.390026445670(0)	-3.900264456697(-1)

(continued on next page)

Table 11 (continued)

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_a/\chi$
75	1.402460694822(0)	2.292778965355(-3)	1.404753473787(0)	-4.047534737873(-1)
76	1.417541777951(0)	2.446827912008(-3)	1.419988605863(0)	-4.199886058627(-1)
77	1.433144123326(0)	2.610127868354(-3)	1.435754251194(0)	-4.357542511944(-1)
78	1.449290995832(0)	2.783222816415(-3)	1.452074218648(0)	-4.520742186480(-1)
79	1.466007133179(0)	2.966692691830(-3)	1.468973825871(0)	-4.689738258706(-1)
80	1.483318862655(0)	3.161156282459(-3)	1.486480018937(0)	-4.864800189373(-1)
81	1.501254229198(0)	3.367274409416(-3)	1.504621503607(0)	-5.046215036074(-1)
82	1.519843136104(0)	3.585753423043(-3)	1.523428889527(0)	-5.234288895268(-1)
83	1.539117499837(0)	3.817349050658(-3)	1.542934848888(0)	-5.429348488881(-1)
84	1.559111420629(0)	4.062870637957(-3)	1.563174291267(0)	-5.631742912671(-1)
85	1.579861370760(0)	4.323185831695(-3)	1.584184556591(0)	-5.841845565914(-1)
86	1.601406402715(0)	4.599225757997(-3)	1.606005628473(0)	-6.060056284727(-1)
87	1.623788379693(0)	4.891990758423(-3)	1.628680370451(0)	-6.286803704511(-1)
88	1.647052231321(0)	5.202556754978(-3)	1.652254788075(0)	-6.522547880755(-1)
89	1.671246237848(0)	5.532082325811(-3)	1.676778320174(0)	-6.767783201742(-1)
90	1.696422346594(0)	5.881816585722(-3)	1.702304163179(0)	-7.023041631792(-1)
91	1.722636524983(0)	6.253107980132(-3)	1.728889632963(0)	-7.288896329634(-1)
92	1.749949155231(0)	6.647414118197(-3)	1.756596569349(0)	-7.565965693494(-1)
93	1.778425476488(0)	7.066312790987(-3)	1.785491789279(0)	-7.854917892786(-1)
94	1.808136081261(0)	7.511514344441(-3)	1.815647595606(0)	-8.156475956056(-1)
95	1.839157474045(0)	7.984875605238(-3)	1.847142349650(0)	-8.471423496501(-1)
96	1.871572701431(0)	8.488415591486(-3)	1.880061117022(0)	-8.800611170220(-1)
97	1.905472064619(0)	9.024333280590(-3)	1.914496397900(0)	-9.144963979007(-1)
98	1.940953927172(0)	9.595027755174(-3)	1.950548954927(0)	-9.505489549269(-1)
99	1.978125633194(0)	1.020312110646(-2)	1.988328754300(0)	-9.883287543003(-1)
100	2.017104553974(0)	1.085148454524(-2)	2.027956038519(0)	-1.027956038519(0)
101	2.058019284542(0)	1.154326825659(-2)	2.069562552799(0)	-1.069562552799(0)
102	2.101011015815(0)	1.228193563933(-2)	2.113292951454(0)	-1.113292951454(0)
103	2.146235113134(0)	1.307130269982(-2)	2.159306415834(0)	-1.159306415834(0)
104	2.193862938351(0)	1.391558352803(-2)	2.207778521879(0)	-1.207778521879(0)
105	2.244083960455(0)	1.481944297963(-2)	2.258903403434(0)	-1.258903403434(0)
106	2.297108209485(0)	1.578805793174(-2)	2.312896267417(0)	-1.312896267417(0)
107	2.353169140691(0)	1.682718878464(-2)	2.369996329476(0)	-1.369996329476(0)
108	2.412526991242(0)	1.794326326537(-2)	2.430470254507(0)	-1.430470254507(0)
109	2.475472731219(0)	1.914347507421(-2)	2.494616206293(0)	-1.494616206293(0)
110	2.542332735385(0)	2.043590053354(-2)	2.562768635918(0)	-1.562768635918(0)
111	2.613474333914(0)	2.182963719064(-2)	2.635303971104(0)	-1.635303971104(0)
112	2.689312441294(0)	2.333496934972(-2)	2.712647410644(0)	-1.712647410644(0)
113	2.770317515875(0)	2.496356684019(-2)	2.795281082715(0)	-1.795281082715(0)
114	2.857025172473(0)	2.672872507417(-2)	2.883753897547(0)	-1.883753897547(0)
115	2.950047862936(0)	2.864565675678(-2)	2.978693519693(0)	-1.978693519693(0)
116	3.050089162975(0)	3.073184869544(-2)	3.080821011670(0)	-2.080821011670(0)
117	3.157961369923(0)	3.300750130959(-2)	3.190968871232(0)	-2.190968871232(0)
118	3.274607342570(0)	3.549607409929(-2)	3.310103416669(0)	-2.310103416669(0)
119	3.401127826022(0)	3.822496811975(-2)	3.439352794142(0)	-2.439352794142(0)
120	3.538815938920(0)	4.122638735947(-2)	3.580042326279(0)	-2.580042326279(0)
121	3.689201113376(0)	4.453843623133(-2)	3.733739549607(0)	-2.733739549607(0)
122	3.854105655062(0)	4.820653229487(-2)	3.902312187357(0)	-2.902312187357(0)
123	4.035718364836(0)	5.228524514904(-2)	4.088003609985(0)	-3.088003609985(0)
124	4.236691544215(0)	5.684071941774(-2)	4.293532263633(0)	-3.293532263633(0)
125	4.460270534118(0)	6.195391036752(-2)	4.522244444486(0)	-3.522244444486(0)
126	4.710469269876(0)	6.772496894350(-2)	4.778194238819(0)	-3.778194238819(0)
127	4.992312123462(0)	7.427928256317(-2)	5.066591406025(0)	-4.066591406025(0)
128	5.312173194704(0)	8.177595004444(-2)	5.393949144748(0)	-4.393949144748(0)
129	5.678262160420(0)	9.041991733960(-2)	5.768682077760(0)	-4.768682077760(0)
130	6.101336268306(0)	1.004797620410(-1)	6.201816030346(0)	-5.201816030346(0)
131	6.595771609328(0)	1.123144521511(-1)	6.708086061479(0)	-5.708086061479(0)
132	7.181224601473(0)	1.264148474915(-1)	7.307639448964(0)	-6.307639448964(0)
133	7.885301411233(0)	1.434703779636(-1)	8.028771789197(0)	-7.028771789197(0)
134	8.748028929348(0)	1.644807220762(-1)	8.912509651424(0)	-7.912509651424(0)
135	9.829725557824(0)	1.909524079344(-1)	1.002067796576(1)	-9.020677965758(0)
136	1.122572569995(1)	2.252666100070(-1)	1.145099230996(1)	-1.045099230996(1)
137	1.309610272444(1)	2.714215865072(-1)	1.336752431095(1)	-1.236752431095(1)

Table 12

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3d_{5/2}$  ( $\mu = \pm 1/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	9.999778123338(-1)	-5.470044859032(-12)	9.999778123283(-1)	2.218767171571(-5)
2	9.999112541123(-1)	-8.751743071904(-11)	9.999112540248(-1)	8.874597524229(-5)
3	9.998003396644(-1)	-4.430292641491(-10)	9.998003392213(-1)	1.996607786658(-4)
4	9.996450928614(-1)	-1.400068598827(-9)	9.996450914614(-1)	3.549085386192(-4)
5	9.994455471027(-1)	-3.417751367396(-9)	9.994455436850(-1)	5.544563150050(-4)
6	9.992017452945(-1)	-7.086074321391(-9)	9.992017382084(-1)	7.982617915864(-4)
7	9.989137398233(-1)	-1.312569421413(-8)	9.989137266976(-1)	1.086273302424(-3)
8	9.985815925235(-1)	-2.238765852793(-8)	9.985815701359(-1)	1.418429864130(-3)
9	9.982053746392(-1)	-3.585308811298(-8)	9.982053387861(-1)	1.794661213908(-3)
10	9.977851667795(-1)	-5.463281217068(-8)	9.977851121467(-1)	2.214887853336(-3)
11	9.973210588691(-1)	-7.996695607898(-8)	9.973209789021(-1)	2.679021097850(-3)
12	9.968131500926(-1)	-1.132244826212(-7)	9.968130368681(-1)	3.186963131872(-3)
13	9.962615488332(-1)	-1.559026872426(-7)	9.962613929305(-1)	3.738607069530(-3)
14	9.956663726057(-1)	-2.096266480226(-7)	9.956661629791(-1)	4.333837020902(-3)
15	9.950277479849(-1)	-2.761486311080(-7)	9.950274718363(-1)	4.972528163727(-3)
16	9.943458105270(-1)	-3.573474524177(-7)	9.943454531795(-1)	5.654546820483(-3)
17	9.936207046870(-1)	-4.552277964833(-7)	9.936202494592(-1)	6.379750540789(-3)
18	9.928525837305(-1)	-5.719194933497(-7)	9.928520118110(-1)	7.147988189013(-3)
19	9.920416096397(-1)	-7.096767545157(-7)	9.920408999630(-1)	7.959100037020(-3)
20	9.911879530154(-1)	-8.708773689483(-7)	9.911870821380(-1)	8.812917861952(-3)
21	9.902917929729(-1)	-1.058021860258(-6)	9.902907349511(-1)	9.709265048945(-3)
22	9.893533170339(-1)	-1.273732606172(-6)	9.893520433013(-1)	1.064795669869(-2)
23	9.883727210132(-1)	-1.520752921497(-6)	9.883712002603(-1)	1.162879973969(-2)
24	9.873502089009(-1)	-1.801946105803(-6)	9.873484069548(-1)	1.265159304520(-2)
25	9.862859927399(-1)	-2.120294457110(-6)	9.862838724454(-1)	1.371612755457(-2)
26	9.851802924992(-1)	-2.478898252910(-6)	9.851778136010(-1)	1.482218639903(-2)
27	9.840333359429(-1)	-2.880974699886(-6)	9.840304549682(-1)	1.596954503175(-2)
28	9.828453584949(-1)	-3.329856853739(-6)	9.828420286380(-1)	1.715797136196(-2)
29	9.816166030994(-1)	-3.828992510571(-6)	9.816127741069(-1)	1.838722589311(-2)
30	9.803473200782(-1)	-4.381943071312(-6)	9.803429381351(-1)	1.9657056186492(-2)
31	9.790377669833(-1)	-4.992382380697(-6)	9.790327746009(-1)	2.096722539910(-2)
32	9.776882084468(-1)	-5.664095542360(-6)	9.776825443513(-1)	2.231745564872(-2)
33	9.762989160267(-1)	-6.400977711618(-6)	9.762925150490(-1)	2.370748495103(-2)
34	9.748701680494(-1)	-7.207032867549(-6)	9.748629610165(-1)	2.513703898351(-2)
35	9.734022494493(-1)	-8.086372566014(-6)	9.733941630767(-1)	2.660583692325(-2)
36	9.718954516055(-1)	-9.043214675269(-6)	9.718864083908(-1)	2.81138160917(-2)
37	9.703500721749(-1)	-1.008188209586(-5)	9.703399902928(-1)	2.966000970723(-2)
38	9.687664149231(-1)	-1.120680146651(-5)	9.687552081216(-1)	3.124479187837(-2)
39	9.671447895529(-1)	-1.242250185767(-5)	9.671323670510(-1)	3.286763294896(-2)
40	9.654855115297(-1)	-1.373361345455(-5)	9.654717779163(-1)	3.452822038375(-2)
41	9.637889019052(-1)	-1.514486623134(-5)	9.637737570390(-1)	3.622624296103(-2)
42	9.620552871386(-1)	-1.666108861833(-5)	9.620386260500(-1)	3.796137395000(-2)
43	9.602849989161(-1)	-1.828720616384(-5)	9.602667117099(-1)	3.973328829009(-2)
44	9.584783739681(-1)	-2.002824019255(-5)	9.584583457279(-1)	4.154165427206(-2)
45	9.566357538856(-1)	-2.188930646226(-5)	9.566138645792(-1)	4.338613542084(-2)
46	9.547574849339(-1)	-2.387561382059(-5)	9.547336093201(-1)	4.526639067992(-2)
47	9.528439178658(-1)	-2.599246286371(-5)	9.528179254030(-1)	4.718207459704(-2)
48	9.508954077334(-1)	-2.824524459860(-5)	9.508671624888(-1)	4.913283751122(-2)
49	9.489123136983(-1)	-3.063943911095(-5)	9.488816742592(-1)	5.111832574082(-2)
50	9.468949988417(-1)	-3.318061424021(-5)	9.468618182275(-1)	5.313818177255(-2)
51	9.448438299730(-1)	-3.587442426375(-5)	9.448079555487(-1)	5.519204445131(-2)
52	9.427591774379(-1)	-3.872660859189(-5)	9.427204508293(-1)	5.727954917073(-2)
53	9.406414149263(-1)	-4.174299047556(-5)	9.405996719358(-1)	5.940032806415(-2)
54	9.384909192797(-1)	-4.492947572831(-5)	9.384459898039(-1)	6.155401019607(-2)
55	9.363080702976(-1)	-4.829205146463(-5)	9.362597782462(-1)	6.374022175384(-2)
56	9.340932505454(-1)	-5.183678485603(-5)	9.340414137605(-1)	6.595858623948(-2)
57	9.318468451605(-1)	-5.556982190695(-5)	9.317912753385(-1)	6.820872466145(-2)
58	9.295692416598(-1)	-5.949738625200(-5)	9.295097442736(-1)	7.049025572644(-2)
59	9.272608297473(-1)	-6.362577797635(-5)	9.271972039693(-1)	7.280279603070(-2)
60	9.249220011212(-1)	-6.796137246096(-5)	9.248540397488(-1)	7.514596025123(-2)
61	9.225531492830(-1)	-7.251061925440(-5)	9.224806386637(-1)	7.751936133630(-2)
62	9.201546693455(-1)	-7.728004097280(-5)	9.200773893045(-1)	7.992261069551(-2)
63	9.177269578432(-1)	-8.227623222977(-5)	9.176446816110(-1)	8.235531838905(-2)
64	9.152704125423(-1)	-8.750585859783(-5)	9.151829066837(-1)	8.481709331626(-2)
65	9.127854322524(-1)	-9.297565560301(-5)	9.126924565968(-1)	8.730754340316(-2)
66	9.102724166387(-1)	-9.869242775424(-5)	9.101737242109(-1)	8.982627578907(-2)
67	9.077317660355(-1)	-1.046630476092(-4)	9.076271029879(-1)	9.237289701209(-2)
68	9.051638812615(-1)	-1.108944548781(-4)	9.050529868066(-1)	9.494701319338(-2)
69	9.025691634353(-1)	-1.173936555671(-4)	9.024517697798(-1)	9.754823022023(-2)
70	8.999480137935(-1)	-1.241677211628(-4)	8.998238460724(-1)	1.001761539276(-1)
71	8.973008335092(-1)	-1.312237878595(-4)	8.971696097213(-1)	1.028303902787(-1)
72	8.946280235127(-1)	-1.385690558303(-4)	8.944894544569(-1)	1.055105455431(-1)
73	8.919299843140(-1)	-1.462107885449(-4)	8.917837735254(-1)	1.082162264746(-1)
74	8.892071158260(-1)	-1.541563121335(-4)	8.890529595138(-1)	1.109470404862(-1)

(continued on next page)

Table 12 (continued)

Z	$X_p'/X$	$X_p''/X$	$X_p/X$	$X_a/X$
75	8.864598171905(-1)	-1.624130147998(-4)	8.862974041757(-1)	1.137025958243(-1)
76	8.836884866057(-1)	-1.709883462850(-4)	8.835174982594(-1)	1.164825017406(-1)
77	8.808935211549(-1)	-1.798898173822(-4)	8.807136313375(-1)	1.192863686625(-1)
78	8.780753166382(-1)	-1.891249995051(-4)	8.778861916387(-1)	1.221138083613(-1)
79	8.752342674053(-1)	-1.987015243106(-4)	8.750355658810(-1)	1.249644341190(-1)
80	8.723707661903(-1)	-2.086270833780(-4)	8.721621391069(-1)	1.278378608931(-1)
81	8.694852039492(-1)	-2.189094279452(-4)	8.692662945213(-1)	1.307337054787(-1)
82	8.665779696988(-1)	-2.295563687045(-4)	8.663484133301(-1)	1.336515866699(-1)
83	8.636494503576(-1)	-2.405757756583(-4)	8.634088745819(-1)	1.365911254181(-1)
84	8.607000305893(-1)	-2.519755780371(-4)	8.604480550113(-1)	1.395519449887(-1)
85	8.577300926482(-1)	-2.637637642805(-4)	8.574663288839(-1)	1.425336711161(-1)
86	8.547400162260(-1)	-2.759483820835(-4)	8.544640678440(-1)	1.455359321560(-1)
87	8.517301783022(-1)	-2.885375385083(-4)	8.514416407637(-1)	1.485583592363(-1)
88	8.487009529947(-1)	-3.015394001648(-4)	8.483994135945(-1)	1.516005864055(-1)
89	8.456527114143(-1)	-3.149621934593(-4)	8.453377492209(-1)	1.546622507791(-1)
90	8.425858215202(-1)	-3.288142049154(-4)	8.422570073152(-1)	1.577429926848(-1)
91	8.395006479774(-1)	-3.431037815654(-4)	8.391575441959(-1)	1.608424558041(-1)
92	8.363975520176(-1)	-3.578393314171(-4)	8.360397126861(-1)	1.639602873139(-1)
93	8.332768912998(-1)	-3.730293239951(-4)	8.329038619758(-1)	1.670961380242(-1)
94	8.301390197753(-1)	-3.886822909597(-4)	8.297503374844(-1)	1.702496625156(-1)
95	8.269842875531(-1)	-4.048068268040(-4)	8.265794807263(-1)	1.734205192737(-1)
96	8.238130407674(-1)	-4.214115896316(-4)	8.233916291778(-1)	1.766083708222(-1)
97	8.206256214478(-1)	-4.385053020162(-4)	8.201871161458(-1)	1.798128838542(-1)
98	8.174223673902(-1)	-4.560967519455(-4)	8.169662706382(-1)	1.830337293618(-1)
99	8.142036120303(-1)	-4.741947938502(-4)	8.137294172365(-1)	1.86270582735(-1)
100	8.109696843186(-1)	-4.928083497204(-4)	8.104768759689(-1)	1.895231240311(-1)
101	8.077209085967(-1)	-5.119464103123(-4)	8.072089621864(-1)	1.927910378136(-1)
102	8.044576044755(-1)	-5.316180364453(-4)	8.039259864391(-1)	1.960740135609(-1)
103	8.011800867149(-1)	-5.518323603931(-4)	8.006282543545(-1)	1.993717456455(-1)
104	7.978886651046(-1)	-5.725985873704(-4)	7.973160665173(-1)	2.026839334827(-1)
105	7.945836443468(-1)	-5.939259971174(-4)	7.939897183497(-1)	2.060102816503(-1)
106	7.912653239395(-1)	-6.158239455840(-4)	7.906494999939(-1)	2.093505000061(-1)
107	7.879339980612(-1)	-6.383018667173(-4)	7.872956961945(-1)	2.127043038055(-1)
108	7.845899554568(-1)	-6.613692743533(-4)	7.839285861825(-1)	2.160714138175(-1)
109	7.812334793244(-1)	-6.850357642167(-4)	7.805484435602(-1)	2.194515564398(-1)
110	7.778648472024(-1)	-7.093110160309(-4)	7.771555361864(-1)	2.228444638136(-1)
111	7.744843308581(-1)	-7.342047957410(-4)	7.737501260624(-1)	2.262498739376(-1)
112	7.710921961762(-1)	-7.597269578530(-4)	7.703324692183(-1)	2.296675307817(-1)
113	7.676887030480(-1)	-7.858874478926(-4)	7.669028156002(-1)	2.330971843998(-1)
114	7.642741052614(-1)	-8.126963049855(-4)	7.634614089564(-1)	2.365385910436(-1)
115	7.608486503897(-1)	-8.401636645650(-4)	7.600084867251(-1)	2.399915132749(-1)
116	7.574125796820(-1)	-8.682997612077(-4)	7.565442799208(-1)	2.434557200792(-1)
117	7.539661279526(-1)	-8.971149316034(-4)	7.530690130210(-1)	2.469309869790(-1)
118	7.505095234697(-1)	-9.266196176622(-4)	7.495829038520(-1)	2.504170961480(-1)
119	7.470429878448(-1)	-9.568243697619(-4)	7.460861634751(-1)	2.539138365249(-1)
120	7.435667359204(-1)	-9.877398501427(-4)	7.425789960703(-1)	2.574210039297(-1)
121	7.400809756571(-1)	-1.019376836451(-3)	7.390615988207(-1)	2.609384011793(-1)
122	7.365859080200(-1)	-1.051746225441(-3)	7.355341617945(-1)	2.644658382055(-1)
123	7.330817268633(-1)	-1.084859036829(-3)	7.319968678264(-1)	2.680031321736(-1)
124	7.295686188139(-1)	-1.118726417328(-3)	7.284498923966(-1)	2.715501076034(-1)
125	7.260467631531(-1)	-1.153359644837(-3)	7.248934035083(-1)	2.751065964917(-1)
126	7.225163316962(-1)	-1.188770132819(-3)	7.213275615634(-1)	2.786724384366(-1)
127	7.189774886702(-1)	-1.224969434860(-3)	7.177525192353(-1)	2.822474807647(-1)
128	7.154303905888(-1)	-1.261969249416(-3)	7.141684213393(-1)	2.858315786607(-1)
129	7.118751861250(-1)	-1.299781424764(-3)	7.105754047002(-1)	2.894245952998(-1)
130	7.083120159804(-1)	-1.338417964147(-3)	7.069735980162(-1)	2.930264019838(-1)
131	7.047410127515(-1)	-1.377891031145(-3)	7.033631217203(-1)	2.966368782797(-1)
132	7.011623007919(-1)	-1.418212955259(-3)	6.997440878366(-1)	3.002559121634(-1)
133	6.975759960713(-1)	-1.459396237726(-3)	6.961165998336(-1)	3.038834001664(-1)
134	6.939822060297(-1)	-1.501453557576(-3)	6.924807524722(-1)	3.075192475278(-1)
135	6.903810294270(-1)	-1.544397777941(-3)	6.888366316491(-1)	3.111633683509(-1)
136	6.867725561878(-1)	-1.588241952616(-3)	6.851843142352(-1)	3.148156857648(-1)
137	6.831568672408(-1)	-1.632999332898(-3)	6.815238679079(-1)	3.184761320921(-1)

Table 13

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3d_{5/2}$  ( $\mu = \pm 3/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	9.99593234278(-1)	-7.384424024217(-11)	9.99593233540(-1)	4.067664604819(-5)
2	9.998373122583(-1)	-1.181397945739(-9)	9.998373110769(-1)	1.626889231329(-4)
3	9.996340221108(-1)	-5.979900139531(-9)	9.996340161309(-1)	3.659838690606(-4)
4	9.993495456119(-1)	-1.889533798419(-8)	9.993495267166(-1)	6.504732834170(-4)
5	9.989840122861(-1)	-4.611833659430(-8)	9.989839661677(-1)	1.016033832271(-3)
6	9.985375884040(-1)	-9.559841800281(-8)	9.985374928056(-1)	1.462507194440(-3)
7	9.980104767876(-1)	-1.770366424555(-7)	9.980102997510(-1)	1.989700249013(-3)
8	9.974029165729(-1)	-3.018766488943(-7)	9.974026146963(-1)	2.597385303703(-3)
9	9.967151829305(-1)	-4.832941151174(-7)	9.967146996364(-1)	3.285300363569(-3)
10	9.959475867452(-1)	-7.361846616651(-7)	9.959468505605(-1)	4.053149439505(-3)
11	9.951004742544(-1)	-1.077150226953(-6)	9.950993971041(-1)	4.900602895851(-3)
12	9.941742266476(-1)	-1.524483944561(-6)	9.941727021636(-1)	5.827297836383(-3)
13	9.931692596257(-1)	-2.098153556862(-6)	9.931671614721(-1)	6.832838527860(-3)
14	9.920860229232(-1)	-2.819783402340(-6)	9.920832031398(-1)	7.916796860235(-3)
15	9.909249997924(-1)	-3.712635016985(-6)	9.909212871574(-1)	9.078712842571(-3)
16	9.896867064528(-1)	-4.801586393061(-6)	9.896819048664(-1)	1.031809513361(-2)
17	9.883716915040(-1)	-6.113109941288(-6)	9.883655783941(-1)	1.163442160590(-2)
18	9.869805353068(-1)	-7.675249205130(-6)	9.869728600576(-1)	1.302713994236(-2)
19	9.855138493305(-1)	-9.517594378283(-6)	9.855043317361(-1)	1.449566826392(-2)
20	9.839722754695(-1)	-1.167125667878(-5)	9.839606042128(-1)	1.603939578717(-2)
21	9.823564853311(-1)	-1.416884163528(-5)	9.823423164895(-1)	1.765768351053(-2)
22	9.806671794937(-1)	-1.704442134290(-5)	9.806501350724(-1)	1.934986492700(-2)
23	9.789050867394(-1)	-2.033350574803(-5)	9.788847532337(-1)	2.111524676630(-2)
24	9.770709632606(-1)	-2.407301302270(-5)	9.770468902476(-1)	2.295310975239(-2)
25	9.751655918433(-1)	-2.830123909100(-5)	9.751372906042(-1)	2.486270939578(-2)
26	9.731897810282(-1)	-3.305782637070(-5)	9.731567232018(-1)	2.684327679817(-2)
27	9.711443642512(-1)	-3.838373179482(-5)	9.711059805194(-1)	2.889401948058(-2)
28	9.690301989652(-1)	-4.432119417822(-5)	9.689858777710(-1)	3.101412222897(-2)
29	9.668481657443(-1)	-5.091370099526(-5)	9.667972520433(-1)	3.320274795674(-2)
30	9.645991673725(-1)	-5.820595463504(-5)	9.645409614179(-1)	3.545903858209(-2)
31	9.622841279191(-1)	-6.624383820076(-5)	9.622178840809(-1)	3.778211591911(-2)
32	9.599039918002(-1)	-7.507438092012(-5)	9.598289174193(-1)	4.017108258068(-2)
33	9.574597228315(-1)	-8.474572323353(-5)	9.573749771083(-1)	4.262502289171(-2)
34	9.549523032704(-1)	-9.530708162660(-5)	9.548569961888(-1)	4.514300381119(-2)
35	9.523827328518(-1)	-1.068087132730(-4)	9.522759241385(-1)	4.772407586147(-2)
36	9.497520278174(-1)	-1.193018805531(-4)	9.496327259369(-1)	5.036727406312(-2)
37	9.470612199415(-1)	-1.328388155140(-4)	9.469283811260(-1)	5.307161887399(-2)
38	9.443113555535(-1)	-1.474726843331(-4)	9.441638828692(-1)	5.583611713084(-2)
39	9.415034945597(-1)	-1.632575518504(-4)	9.413402370078(-1)	5.865976299218(-2)
40	9.386387094655(-1)	-1.802483462297(-4)	9.384584611193(-1)	6.154153888075(-2)
41	9.357180843995(-1)	-1.985008238097(-4)	9.355195835757(-1)	6.448041642427(-2)
42	9.327427141410(-1)	-2.180715342043(-4)	9.325246426068(-1)	6.747535739317(-2)
43	9.297137031519(-1)	-2.390177857096(-4)	9.294746853662(-1)	7.052531463376(-2)
44	9.266321646153(-1)	-2.613976110732(-4)	9.263707670043(-1)	7.362923299574(-2)
45	9.234992194810(-1)	-2.852697336812(-4)	9.232139497474(-1)	7.678605025265(-2)
46	9.203159955201(-1)	-3.106935342139(-4)	9.200053019859(-1)	7.999469801414(-2)
47	9.170836263890(-1)	-3.377290178225(-4)	9.167458973712(-1)	8.325410262885(-2)
48	9.138032507052(-1)	-3.664367818743(-4)	9.134368139233(-1)	8.656318607670(-2)
49	9.104760111345(-1)	-3.968779843135(-4)	9.100791331502(-1)	8.992086684980(-2)
50	9.071030534921(-1)	-4.291143126833(-4)	9.066739391794(-1)	9.332606082056(-2)
51	9.036855258574(-1)	-4.632079538498(-4)	9.032223179036(-1)	9.677768209642(-2)
52	9.002245777044(-1)	-4.992215644709(-4)	8.997253561399(-1)	1.002746438601(-1)
53	8.967213590480(-1)	-5.372182422462(-4)	8.961841408057(-1)	1.038158591943(-1)
54	8.931770196071(-1)	-5.772614979861(-4)	8.925997581092(-1)	1.074002418908(-1)
55	8.895927079861(-1)	-6.194152285327(-4)	8.889732927575(-1)	1.110267072425(-1)
56	8.859695708733(-1)	-6.637436905657(-4)	8.853058271828(-1)	1.146941728172(-1)
57	8.823087522605(-1)	-7.103114753215(-4)	8.815984407852(-1)	1.184015592148(-1)
58	8.786113926802(-1)	-7.591834842556(-4)	8.778522091959(-1)	1.221477908041(-1)
59	8.748786284644(-1)	-8.104249056709(-4)	8.740682035587(-1)	1.259317964413(-1)
60	8.71115910236(-1)	-8.641011923380(-4)	8.702474898312(-1)	1.297525101688(-1)
61	8.673114061470(-1)	-9.202780401265(-4)	8.663911281069(-1)	1.336088718931(-1)
62	8.634791933245(-1)	-9.790213676695(-4)	8.625001719569(-1)	1.374998280431(-1)
63	8.596160650899(-1)	-1.040397297075(-3)	8.585756677929(-1)	1.414243322071(-1)
64	8.557231263872(-1)	-1.104472135703(-3)	8.546186542514(-1)	1.453813457486(-1)
65	8.518014739581(-1)	-1.171312359022(-3)	8.506301615991(-1)	1.493698384009(-1)
66	8.478521957535(-1)	-1.240984594551(-3)	8.466112111589(-1)	1.533887888411(-1)
67	8.438763703661(-1)	-1.313555606905(-3)	8.425628147592(-1)	1.574371852408(-1)
68	8.398750664870(-1)	-1.389092283949(-3)	8.384859742030(-1)	1.615140257970(-1)
69	8.358493423840(-1)	-1.467661624061(-3)	8.343816807600(-1)	1.656183192400(-1)
70	8.318002454039(-1)	-1.549330724525(-3)	8.302509146793(-1)	1.697490853207(-1)
71	8.277288114959(-1)	-1.634166771037(-3)	8.260946447249(-1)	1.739053552751(-1)
72	8.236360647595(-1)	-1.722237028344(-3)	8.219138277312(-1)	1.780861722688(-1)
73	8.195230170130(-1)	-1.813608832008(-3)	8.177094081810(-1)	1.822905918190(-1)
74	8.153906673855(-1)	-1.908349581294(-3)	8.134823178042(-1)	1.865176821958(-1)

(continued on next page)

Table 13 (continued)

Z	$\chi_p'/X$	$\chi_p''/X$	$\chi_p/X$	$\chi_d/X$
75	8.112400019308(-1)	-2.006526733189(-3)	8.092334751976(-1)	1.907665248024(-1)
76	8.070719932626(-1)	-2.108207797538(-3)	8.049637854651(-1)	1.950362145349(-1)
77	8.028876002120(-1)	-2.213460333301(-3)	8.006741398787(-1)	1.993258601213(-1)
78	7.986877675058(-1)	-2.322351945929(-3)	7.963654155598(-1)	2.036345844402(-1)
79	7.944734254656(-1)	-2.434950285841(-3)	7.920384751798(-1)	2.079615248202(-1)
80	7.902454897283(-1)	-2.551323048015(-3)	7.876941666803(-1)	2.123058333197(-1)
81	7.860048609858(-1)	-2.671537972668(-3)	7.833333230131(-1)	2.166666769869(-1)
82	7.817524247450(-1)	-2.795662847029(-3)	7.789567618980(-1)	2.210432381020(-1)
83	7.774890511076(-1)	-2.923765508198(-3)	7.745652855994(-1)	2.254347144006(-1)
84	7.732155945676(-1)	-3.055913847069(-3)	7.701596807205(-1)	2.298403192795(-1)
85	7.689328938287(-1)	-3.192175813334(-3)	7.657407180154(-1)	2.342592819846(-1)
86	7.646417716388(-1)	-3.332619421528(-3)	7.613091522172(-1)	2.386908477828(-1)
87	7.603430346421(-1)	-3.477312758136(-3)	7.568657218839(-1)	2.431342781161(-1)
88	7.560374732486(-1)	-3.626323989732(-3)	7.524111492589(-1)	2.475888507411(-1)
89	7.517258615201(-1)	-3.779721372150(-3)	7.479461401479(-1)	2.520538598521(-1)
90	7.474089570710(-1)	-3.937573260680(-3)	7.434713838104(-1)	2.565286161896(-1)
91	7.430875009868(-1)	-4.099948121273(-3)	7.389875528655(-1)	2.610124471345(-1)
92	7.387622177550(-1)	-4.266914542758(-3)	7.344953032122(-1)	2.655046967878(-1)
93	7.344338152123(-1)	-4.438541250043(-3)	7.299952739623(-1)	2.700047260377(-1)
94	7.301029845047(-1)	-4.614897118320(-3)	7.254880873864(-1)	2.745119126136(-1)
95	7.257704000608(-1)	-4.796051188245(-3)	7.209743488725(-1)	2.790256511275(-1)
96	7.214367195783(-1)	-4.982072682087(-3)	7.164546468962(-1)	2.835453531038(-1)
97	7.171025840223(-1)	-5.173031020856(-3)	7.119295530015(-1)	2.880704469985(-1)
98	7.127686176357(-1)	-5.368995842390(-3)	7.073996217933(-1)	2.926003782067(-1)
99	7.084354279594(-1)	-5.570037020397(-3)	7.028653909390(-1)	2.971346090610(-1)
100	7.041036058650(-1)	-5.776224684454(-3)	6.983273811806(-1)	3.016726188194(-1)
101	6.997737255955(-1)	-5.987629240957(-3)	6.937860963546(-1)	3.062139036454(-1)
102	6.954463448167(-1)	-6.204321395021(-3)	6.892420234217(-1)	3.107579765783(-1)
103	6.911220046768(-1)	-6.426372173320(-3)	6.846956325035(-1)	3.153043674965(-1)
104	6.868012298747(-1)	-6.653852947880(-3)	6.801473769268(-1)	3.198526230732(-1)
105	6.824845287361(-1)	-6.886835460817(-3)	6.755976932753(-1)	3.244023067247(-1)
106	6.781723932964(-1)	-7.125391850025(-3)	6.710470014463(-1)	3.289529985537(-1)
107	6.738652993909(-1)	-7.369594675813(-3)	6.664957047151(-1)	3.335042952849(-1)
108	6.695637067514(-1)	-7.619516948501(-3)	6.619441898029(-1)	3.380558101971(-1)
109	6.652680591075(-1)	-7.875232156976(-3)	6.573928269505(-1)	3.426071730495(-1)
110	6.609787842943(-1)	-8.136814298221(-3)	6.528419699961(-1)	3.471580300039(-1)
111	6.566962943643(-1)	-8.404337907816(-3)	6.482919564565(-1)	3.517080435435(-1)
112	6.524209857035(-1)	-8.677878091428(-3)	6.437431076121(-1)	3.562568923879(-1)
113	6.481532391517(-1)	-8.957510557307(-3)	6.391957285943(-1)	3.608042714057(-1)
114	6.438934201252(-1)	-9.243311649782(-3)	6.346501084754(-1)	3.653498915246(-1)
115	6.396418787437(-1)	-9.535358383797(-3)	6.301065203599(-1)	3.698934796401(-1)
116	6.353989499582(-1)	-9.833728480485(-3)	6.255652214778(-1)	3.74434785222(-1)
117	6.311649536820(-1)	-1.013850040381(-2)	6.210264532782(-1)	3.789735467218(-1)
118	6.269401949222(-1)	-1.044975339827(-2)	6.164904415239(-1)	3.835095584761(-1)
119	6.227249639127(-1)	-1.076756752778(-2)	6.119573963849(-1)	3.880426036151(-1)
120	6.185195362484(-1)	-1.109202371557(-2)	6.074275125328(-1)	3.925724874672(-1)
121	6.143241730182(-1)	-1.142320378535(-2)	6.029009692329(-1)	3.970990307671(-1)
122	6.101391209394(-1)	-1.176119050361(-2)	5.983779304358(-1)	4.016220695642(-1)
123	6.059646124901(-1)	-1.210606762315(-2)	5.938585448669(-1)	4.061414551331(-1)
124	6.018008660412(-1)	-1.245791992789(-2)	5.893429461133(-1)	4.106570538867(-1)
125	5.976480859872(-1)	-1.281683327892(-2)	5.848312527083(-1)	4.151687472917(-1)
126	5.935064628746(-1)	-1.318289466195(-2)	5.803235682127(-1)	4.196764317873(-1)
127	5.893761735285(-1)	-1.355619223609(-2)	5.758199812924(-1)	4.241800187076(-1)
128	5.852573811760(-1)	-1.393681538407(-2)	5.713205657919(-1)	4.286794342081(-1)
129	5.811502355675(-1)	-1.432485476393(-2)	5.668253808036(-1)	4.331746191964(-1)
130	5.770548730936(-1)	-1.472040236223(-2)	5.623344707314(-1)	4.376655292686(-1)
131	5.729714168992(-1)	-1.512355154888(-2)	5.578478653503(-1)	4.421521346497(-1)
132	5.688999769922(-1)	-1.553439713354(-2)	5.533655798586(-1)	4.466344201414(-1)
133	5.648406503490(-1)	-1.595303542379(-2)	5.488876149252(-1)	4.511123850748(-1)
134	5.607935210143(-1)	-1.637956428506(-2)	5.444139567292(-1)	4.555860432708(-1)
135	5.567586601950(-1)	-1.681408320237(-2)	5.399445769927(-1)	4.600554230073(-1)
136	5.527361263501(-1)	-1.725669334406(-2)	5.354794330060(-1)	4.645205669940(-1)
137	5.487259652723(-1)	-1.770749762746(-2)	5.310184676448(-1)	4.689815323552(-1)



Table 14

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state  $3d_{5/2}$  ( $\mu = \pm 5/2$ ), obtained with  $\alpha^{-1} = 137.035999084$  (CODATA 2018).

Z	$\chi_p'/\chi$	$\chi_p''/\chi$	$\chi_p/\chi$	$\chi_d/\chi$
1	-3.236280289539(-14)	-3.698043551561(-6)	-3.698043583924(-6)	1.00003698044(0)
2	-5.178261931528(-13)	-1.479256807213(-5)	-1.479256858996(-5)	1.000014792569(0)
3	-2.621675231832(-12)	-3.328475526576(-5)	-3.328475788744(-5)	1.000033284758(0)
4	-8.286585502781(-12)	-5.917657499383(-5)	-5.917658328042(-5)	1.000059176583(0)
5	-2.023342416575(-11)	-9.247078580723(-5)	-9.247080604066(-5)	1.000092470806(0)
6	-4.196237209107(-11)	-1.331709356918(-4)	-1.331709776541(-4)	1.000133170978(0)
7	-7.775436773679(-11)	-1.812813630271(-4)	-1.812814407815(-4)	1.000181281441(0)
8	-1.326728736192(-10)	-2.368071977600(-4)	-2.368073304329(-4)	1.000236807330(0)
9	-2.125659664182(-10)	-2.997543627921(-4)	-2.997545753581(-4)	1.000299754575(0)
10	-3.240687519499(-10)	-3.701295755830(-4)	-3.701298996518(-4)	1.000370129900(0)
11	-4.746061064329(-10)	-4.479403499701(-4)	-4.479408245762(-4)	1.000447940825(0)
12	-6.723957456662(-10)	-5.331949982045(-4)	-5.331956706002(-4)	1.000533195671(0)
13	-9.264516239345(-10)	-6.259026332066(-4)	-6.259035596582(-4)	1.000625903560(0)
14	-1.246587664652(-9)	-7.260731710395(-4)	-7.260744176271(-4)	1.000726074418(0)
15	-1.643421824951(-9)	-8.337173336041(-4)	-8.337189770259(-4)	1.000833718977(0)
16	-2.128380496637(-9)	-9.488466515556(-4)	-9.488487799361(-4)	1.000948848780(0)
17	-2.713703246102(-9)	-1.071473467444(-3)	-1.071476181147(-3)	1.001071476181(0)
18	-3.412447896042(-9)	-1.201610939077(-3)	-1.201614351525(-3)	1.001201614352(0)
19	-4.238495951978(-9)	-1.339273043117(-3)	-1.339277281613(-3)	1.001339277282(0)
20	-5.206558376832(-9)	-1.484474578897(-3)	-1.484479785455(-3)	1.001484479785(0)
21	-6.332181717001(-9)	-1.637231172472(-3)	-1.637237504653(-3)	1.001637237505(0)
22	-7.631754583596(-9)	-1.797559280906(-3)	-1.797566912660(-3)	1.001797566913(0)
23	-9.122514492720(-9)	-1.965476196788(-3)	-1.965485319303(-3)	1.001965485319(0)
24	-1.082255506891(-8)	-2.141000052990(-3)	-2.141010875545(-3)	1.002141010876(0)
25	-1.275083361607(-8)	-2.324149827662(-3)	-2.324162578496(-3)	1.002324162578(0)
26	-1.492717906040(-8)	-2.514945349468(-3)	-2.514960276647(-3)	1.002514960277(0)
27	-1.737230027029(-8)	-2.713407303072(-3)	-2.713424675372(-3)	1.002713424675(0)
28	-2.010779475794(-8)	-2.919557234867(-3)	-2.919577342662(-3)	1.002919577343(0)
29	-2.315615776828(-8)	-3.133417558960(-3)	-3.133440715117(-3)	1.003133440715(0)
30	-2.654079176049(-8)	-3.355011563402(-3)	-3.355038104194(-3)	1.003355038104(0)
31	-3.028601628805(-8)	-3.584363416687(-3)	-3.584393702703(-3)	1.003584393703(0)
32	-3.441707828325(-8)	-3.821498174504(-3)	-3.821532591582(-3)	1.003821532592(0)
33	-3.896016275252(-8)	-4.066441786753(-3)	-4.066480746915(-3)	1.004066480747(0)
34	-4.394240388920(-8)	-4.319221104834(-3)	-4.319265047238(-3)	1.004319265047(0)
35	-4.939189661045(-8)	-4.579863889205(-3)	-4.579913281101(-3)	1.004579913281(0)
36	-5.533770852559(-8)	-4.848398817214(-3)	-4.848454154923(-3)	1.004848454155(0)
37	-6.180989234317(-8)	-5.124855491218(-3)	-5.124917301110(-3)	1.005124917301(0)
38	-6.883949872459(-8)	-5.409264446974(-3)	-5.409333286473(-3)	1.005409332866(0)
39	-7.645858959216(-8)	-5.701657162336(-3)	-5.701733620926(-3)	1.005701733621(0)
40	-8.470025190003(-8)	-6.002066066230(-3)	-6.002150766482(-3)	1.006002150766(0)
41	-9.359861187663(-8)	-6.310524547937(-3)	-6.310618146549(-3)	1.006310618147(0)
42	-1.031888497475(-7)	-6.627066966677(-3)	-6.627170155527(-3)	1.006627170156(0)
43	-1.135072149478(-7)	-6.951728661501(-3)	-6.951842168716(-3)	1.006951842169(0)
44	-1.245910418345(-7)	-7.284545961500(-3)	-7.284670552542(-3)	1.007284670553(0)
45	-1.364787659078(-7)	-7.625556196329(-3)	-7.625692675095(-3)	1.007625692675(0)
46	-1.492099405521(-7)	-7.974797707066(-3)	-7.974946917007(-3)	1.007974946917(0)
47	-1.628252543076(-7)	-8.332309857391(-3)	-8.332472682645(-3)	1.008332472683(0)
48	-1.773665486842(-7)	-8.698133045113(-3)	-8.698310411662(-3)	1.008698310412(0)
49	-1.928768365274(-7)	-9.072308714036(-3)	-9.072501590873(-3)	1.009072501591(0)
50	-2.094003209496(-7)	-9.454879366181(-3)	-9.455088766502(-3)	1.009455088767(0)
51	-2.269824148398(-7)	-9.845888574359(-3)	-9.846115556774(-3)	1.009846115557(0)
52	-2.456697609618(-7)	-1.024538099512(-2)	-1.024562666488(-2)	1.010245626665(0)
53	-2.655102526569(-7)	-1.065340238206(-2)	-1.065366789231(-2)	1.010653667892(0)
54	-2.865530551633(-7)	-1.106999595952(-2)	-1.107028615258(-2)	1.011070286153(0)
55	-3.088486275666(-7)	-1.149522063669(-2)	-1.149552948532(-2)	1.011495529485(0)
56	-3.324487453959(-7)	-1.192911462205(-2)	-1.192944707080(-2)	1.011929447071(0)
57	-3.574065238811(-7)	-1.237173183829(-2)	-1.237208924482(-2)	1.012372089245(0)
58	-3.837764418863(-7)	-1.282312373760(-2)	-1.282350751404(-2)	1.012823507514(0)
59	-4.116143665361(-7)	-1.328334295737(-2)	-1.328375457174(-2)	1.013283754572(0)
60	-4.409775785512(-7)	-1.375244333639(-2)	-1.375288431397(-2)	1.013752884314(0)
61	-4.719247983102(-7)	-1.423047993140(-2)	-1.423095185620(-2)	1.014230951856(0)
62	-5.045162126562(-7)	-1.471750903416(-2)	-1.471801355038(-2)	1.014718013550(0)
63	-5.388135024661(-7)	-1.521358818898(-2)	-1.521412700248(-2)	1.015214127002(0)
64	-5.748798710019(-7)	-1.571877621063(-2)	-1.571935109050(-2)	1.015719351090(0)
65	-6.127800730635(-7)	-1.623313320288(-2)	-1.623374598296(-2)	1.016233745983(0)
66	-6.525804449631(-7)	-1.675672057744(-2)	-1.675737315789(-2)	1.016757373158(0)
67	-6.943489353434(-7)	-1.728960107339(-2)	-1.729029542233(-2)	1.017290295422(0)
68	-7.381551368598(-7)	-1.783183877720(-2)	-1.783257693234(-2)	1.017832576932(0)
69	-7.840703187499(-7)	-1.838349914324(-2)	-1.838428321356(-2)	1.018384283214(0)
70	-8.321674603138(-7)	-1.894464901482(-2)	-1.894548118228(-2)	1.018945481182(0)
71	-8.825212853286(-7)	-1.951535664581(-2)	-1.951623916709(-2)	1.019516239167(0)
72	-9.352082974217(-7)	-2.009569172284(-2)	-2.009662693114(-2)	1.020096626931(0)
73	-9.903068164298(-7)	-2.068572538807(-2)	-2.068671569489(-2)	1.020686715695(0)
74	-1.047897015768(-6)	-2.128553026254(-2)	-2.128657815955(-2)	1.021286578160(0)

(continued on next page)



Table 14 (continued)

Z	$\chi_p''/X$	$\chi_p''/X$	$\chi_p/X$	$\chi_a/X$
75	-1.108060960841(-6)	-2.189518047014(-2)	-2.189628853110(-2)	1.021896288531(0)
76	-1.170882648513(-6)	-2.251475166227(-2)	-2.251592254492(-2)	1.022515922545(0)
77	-1.236448047688(-6)	-2.314432104308(-2)	-2.314555749112(-2)	1.023145557491(0)
78	-1.304845141001(-6)	-2.378396739536(-2)	-2.378527224050(-2)	1.023785272240(0)
79	-1.376163967679(-6)	-2.443377110718(-2)	-2.443514727115(-2)	1.024435147271(0)
80	-1.450496667584(-6)	-2.509381419918(-2)	-2.509526469585(-2)	1.025095264696(0)
81	-1.527937526489(-6)	-2.576418035258(-2)	-2.576570829010(-2)	1.025765708290(0)
82	-1.608583022601(-6)	-2.644495493791(-2)	-2.644656352093(-2)	1.026446563521(0)
83	-1.692531874385(-6)	-2.713622504456(-2)	-2.713791757644(-2)	1.027137917576(0)
84	-1.779885089720(-6)	-2.783807951102(-2)	-2.783985939611(-2)	1.027839859396(0)
85	-1.870746016419(-6)	-2.855060895597(-2)	-2.855247970198(-2)	1.028552479702(0)
86	-1.965220394161(-6)	-2.927390581014(-2)	-2.927587103054(-2)	1.029275871031(0)
87	-2.063416407874(-6)	-3.000806434911(-2)	-3.001012776551(-2)	1.030010127766(0)
88	-2.165444742604(-6)	-3.075318072681(-2)	-3.075534617155(-2)	1.030755346172(0)
89	-2.271418639930(-6)	-3.150935301008(-2)	-3.151162442872(-2)	1.031511624429(0)
90	-2.381453955948(-6)	-3.227668121401(-2)	-3.227906266797(-2)	1.032279062668(0)
91	-2.495669220893(-6)	-3.305526733828(-2)	-3.305776300750(-2)	1.033057763008(0)
92	-2.614185700431(-6)	-3.384521540445(-2)	-3.384782959015(-2)	1.033847829590(0)
93	-2.737127458683(-6)	-3.464663149423(-2)	-3.464936862169(-2)	1.034649368622(0)
94	-2.864621423023(-6)	-3.545962378879(-2)	-3.546248841021(-2)	1.035462488410(0)
95	-2.996797450712(-6)	-3.628430260908(-2)	-3.628729940653(-2)	1.036287299407(0)
96	-3.133788397416(-6)	-3.712078045727(-2)	-3.712391424567(-2)	1.037123914246(0)
97	-3.275730187678(-6)	-3.796917205927(-2)	-3.797244778946(-2)	1.037972447789(0)
98	-3.422761887386(-6)	-3.882959440841(-2)	-3.883301717030(-2)	1.038833017170(0)
99	-3.575025778314(-6)	-3.970216681025(-2)	-3.970574183603(-2)	1.039705741836(0)
100	-3.732667434797(-6)	-4.058701092869(-2)	-4.059074359612(-2)	1.040590743596(0)
101	-3.895835802595(-6)	-4.148425083319(-2)	-4.148814666899(-2)	1.041488146669(0)
102	-4.064683280038(-6)	-4.239401304743(-2)	-4.239807773071(-2)	1.042398077731(0)
103	-4.239365801491(-6)	-4.331642659914(-2)	-4.332066596494(-2)	1.043320665965(0)
104	-4.420042923250(-6)	-4.425162307139(-2)	-4.425604311431(-2)	1.044256043114(0)
105	-4.606877911912(-6)	-4.519973665524(-2)	-4.520434353316(-2)	1.045204343533(0)
106	-4.800037835320(-6)	-4.616090420386(-2)	-4.616570424170(-2)	1.046165704242(0)
107	-4.999693656156(-6)	-4.713526528808(-2)	-4.714026498174(-2)	1.047140264982(0)
108	-5.206020328270(-6)	-4.812296225354(-2)	-4.812816827387(-2)	1.048128168274(0)
109	-5.419196895833(-6)	-4.912414027936(-2)	-4.912955947626(-2)	1.049129559476(0)
110	-5.639406595408(-6)	-5.013894743853(-2)	-5.014458684513(-2)	1.050144586845(0)
111	-5.866836961024(-6)	-5.116753475986(-2)	-5.117340159682(-2)	1.051173401597(0)
112	-6.101679932369(-6)	-5.221005629173(-2)	-5.221615797166(-2)	1.052216157972(0)
113	-6.344131966188(-6)	-5.326666916767(-2)	-5.327301329964(-2)	1.053273013300(0)
114	-6.594394151007(-6)	-5.433753367369(-2)	-5.434412806784(-2)	1.054344128068(0)
115	-6.852672325272(-6)	-5.542281331755(-2)	-5.542966598987(-2)	1.055429665990(0)
116	-7.119177199050(-6)	-5.652267490004(-2)	-5.652979407724(-2)	1.056529794077(0)
117	-7.394124479371(-6)	-5.763728858824(-2)	-5.764468271271(-2)	1.057644682713(0)
118	-7.677734999376(-6)	-5.876682799084(-2)	-5.877450572583(-2)	1.058774505726(0)
119	-7.970234851359(-6)	-5.991147023571(-2)	-5.991944047056(-2)	1.059919440471(0)
120	-8.271855523874(-6)	-6.107139604965(-2)	-6.107966790517(-2)	1.061079667905(0)
121	-8.582834043013(-6)	-6.224678984042(-2)	-6.225537267446(-2)	1.062255372674(0)
122	-8.903413118018(-6)	-6.343783978118(-2)	-6.344674319430(-2)	1.063446743194(0)
123	-9.233841291376(-6)	-6.464473789744(-2)	-6.465397173874(-2)	1.064653971739(0)
124	-9.574373093538(-6)	-6.586768015644(-2)	-6.587725452954(-2)	1.065877254530(0)
125	-9.925269202441(-6)	-6.710686655925(-2)	-6.711679182845(-2)	1.067116791828(0)
126	-1.028679660799(-5)	-6.836250123554(-2)	-6.837278803215(-2)	1.068372788032(0)
127	-1.065922878167(-5)	-6.963479254118(-2)	-6.964545176997(-2)	1.069645451770(0)
128	-1.104284585148(-5)	-7.092395315876(-2)	-7.093499600461(-2)	1.070934996005(0)
129	-1.143793478241(-5)	-7.223020020104(-2)	-7.224163813582(-2)	1.072241638136(0)
130	-1.184478956255(-5)	-7.35537531759(-2)	-7.356560010715(-2)	1.073565600107(0)
131	-1.226371139514(-5)	-7.489484480461(-2)	-7.490710851600(-2)	1.074907108516(0)
132	-1.269500889680(-5)	-7.625369971805(-2)	-7.626639472695(-2)	1.076266394727(0)
133	-1.313899830200(-5)	-7.763055599025(-2)	-7.764369498856(-2)	1.077643694989(0)
134	-1.359600367416(-5)	-7.902565455004(-2)	-7.903925055372(-2)	1.079039250554(0)
135	-1.406635712360(-5)	-8.043924144661(-2)	-8.045330780373(-2)	1.080453307804(0)
136	-1.455039903242(-5)	-8.187156797715(-2)	-8.188611837618(-2)	1.081886118376(0)
137	-1.504847828690(-5)	-8.332289081852(-2)	-8.333793929681(-2)	1.083337939297(0)



**Table 15**

Relativistic total magnetizabilities  $\chi = \chi_d + \chi_p$  (in the units of  $\alpha^2 a_0^3$ ) for states  $1s_{1/2}$ ,  $2s_{1/2}$ ,  $2p_{1/2}$  and  $2p_{3/2}$  of selected hydrogenlike ions, obtained with  $\alpha^{-1} = 137.035\,999\,139$  (CODATA 2014) [the upper entries] and with  $\alpha^{-1} = 137.035\,999\,084$  (CODATA 2018) [the lower entries].

Z	$1s_{1/2}$	$2s_{1/2}$	$2p_{1/2}$	$2p_{3/2} (\mu = \pm 1/2)$	$2p_{3/2} (\mu = \pm 3/2)$
1	-4.999 644 993 669(-1)	-6.999 722 649 147(+ 0)	6.676 163 152 752(+ 4)	-6.677 063 123 774(+ 4)	-5.999 861 546 894(+ 0)
	-4.999 644 993 668(-1)	-6.999 722 649 147(+ 0)	6.676 163 147 392(+ 4)	-6.677 063 118 415(+ 4)	-5.999 861 546 894(+ 0)
2	-1.249 645 001 764(-1)	-1.749 722 649 002(+ 0)	4.171 164 660 772(+ 3)	-4.173 414 370 995(+ 3)	-1.499 861 548 141(+ 0)
	-1.249 645 001 764(-1)	-1.749 722 649 002(+ 0)	4.171 164 657 423(+ 3)	-4.173 414 367 645(+ 3)	-1.499 861 548 141(+ 0)
5	-1.996 450 584 458(-2)	-2.797 226 479 764(-1)	1.065 244 131 032(+ 2)	-1.068 841 233 198(+ 2)	-2.398 615 568 695(-1)
	-1.996 450 584 456(-2)	-2.797 226 479 762(-1)	1.065 244 130 174(+ 2)	-1.068 841 232 340(+ 2)	-2.398 615 568 694(-1)
7	-1.016 859 395 768(-2)	-1.425 797 896 419(-1)	2.765 269 415 830(+ 1)	-2.783 607 783 733(+ 1)	-1.223 105 464 382(-1)
	-1.016 859 395 765(-2)	-1.425 797 896 417(-1)	2.765 269 413 598(+ 1)	-2.783 607 781 500(+ 1)	-1.223 105 464 381(-1)
10	-4.964 526 105 003(-3)	-6.972 264 418 235(-2)	6.600 466 097 095(+ 0)	-6.690 176 291 750(+ 0)	-5.986 158 805 136(-2)
	-4.964 526 104 975(-3)	-6.972 264 418 212(-2)	6.600 466 091 735(+ 0)	-6.690 176 286 391(+ 0)	-5.986 158 805 125(-2)
20	-1.214 607 414 490(-3)	-1.722 262 691 678(-2)	3.983 443 339 545(-1)	-4.205 544 369 778(-1)	-1.486 171 290 440(-2)
	-1.214 607 414 461(-3)	-1.722 262 691 655(-2)	3.983 443 336 197(-1)	-4.205 544 366 428(-1)	-1.486 171 290 429(-2)
40	-2.774 370 778 562(-4)	-4.097 522 252 752(-3)	2.149 268 284 498(-2)	-2.682 735 569 862(-2)	-3.612 214 346 049(-3)
	-2.774 370 778 284(-4)	-4.097 522 252 529(-3)	2.149 268 282 421(-2)	-2.682 735 567 761(-2)	-3.612 214 345 939(-3)
50	-1.651 892 129 562(-4)	-2.522 402 512 753(-3)	7.818 803 550 735(-3)	-1.112 807 953 802(-2)	-2.262 592 588 983(-3)
	-1.651 892 129 288(-4)	-2.522 402 512 530(-3)	7.818 803 542 322(-3)	-1.112 807 952 938(-2)	-2.262 592 588 874(-3)
80	-4.446 245 639 716(-5)	-8.150 967 719 944(-4)	6.338 207 576 445(-4)	-1.746 639 554 569(-3)	-8.017 538 525 544(-4)
	-4.446 245 637 172(-5)	-8.150 967 717 686(-4)	6.338 207 564 971(-4)	-1.746 639 553 181(-3)	-8.017 538 524 477(-4)
100	-1.749 820 929 318(-5)	-4.191 628 402 646(-4)	1.023 054 311 643(-4)	-7.040 609 243 754(-4)	-4.658 211 084 276(-4)
	-1.749 820 926 981(-5)	-4.191 628 400 323(-4)	1.023 054 307 897(-4)	-7.040 609 237 467(-4)	-4.658 211 083 234(-4)
120	-3.838 526 853 900(-6)	-1.990 375 839 852(-4)	-8.557 571 732 907(-6)	-3.048 757 238 860(-4)	-2.844 509 502 864(-4)
	-3.838 526 833 771(-6)	-1.990 375 837 283(-4)	-8.557 571 825 120(-6)	-3.048 757 234 863(-4)	-2.844 509 501 855(-4)
130	2.099 852 117 594(-7)	-1.184 030 625 960(-4)	-1.633 283 429 506(-5)	-1.847 126 573 331(-4)	-2.239 544 235 860(-4)
	2.099 852 292 247(-7)	-1.184 030 622 847(-4)	-1.633 283 430 363(-5)	-1.847 126 568 800(-4)	-2.239 544 234 870(-4)
137	2.154 582 953 028(-6)	-4.903 302 713 912(-5)	-9.398 566 990 645(-6)	-4.903 236 487 356(-5)	-1.894 662 493 029(-4)
	2.154 582 966 618(-6)	-4.903 302 450 115(-5)	-9.398 566 506 191(-6)	-4.903 235 466 649(-5)	-1.894 662 492 054(-4)